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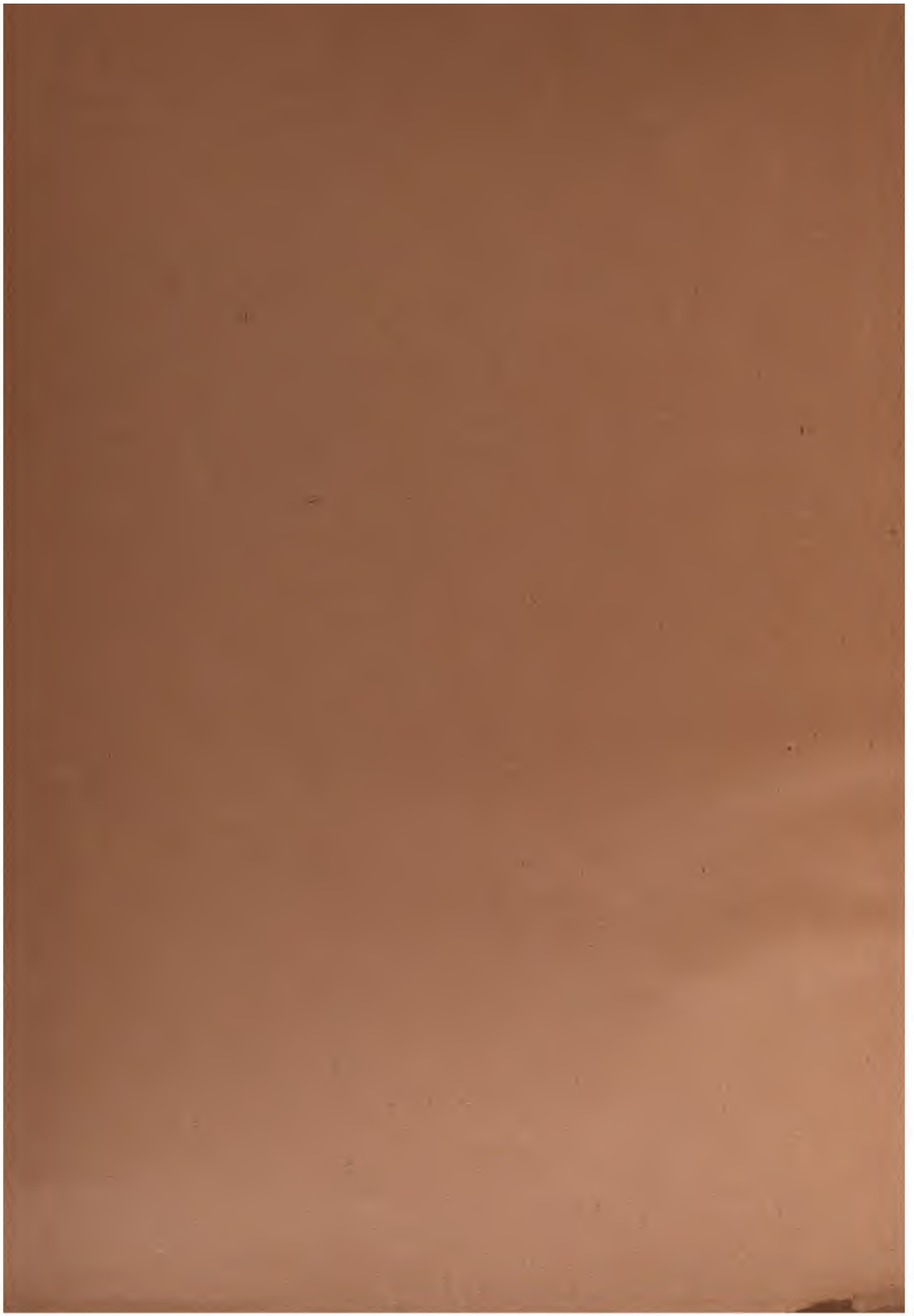

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REPORT TO THE TRUSTEES

OF THE

"JAMES LICK TRUST"

OF

OBSERVATIONS MADE ON MT. HAMILTON.

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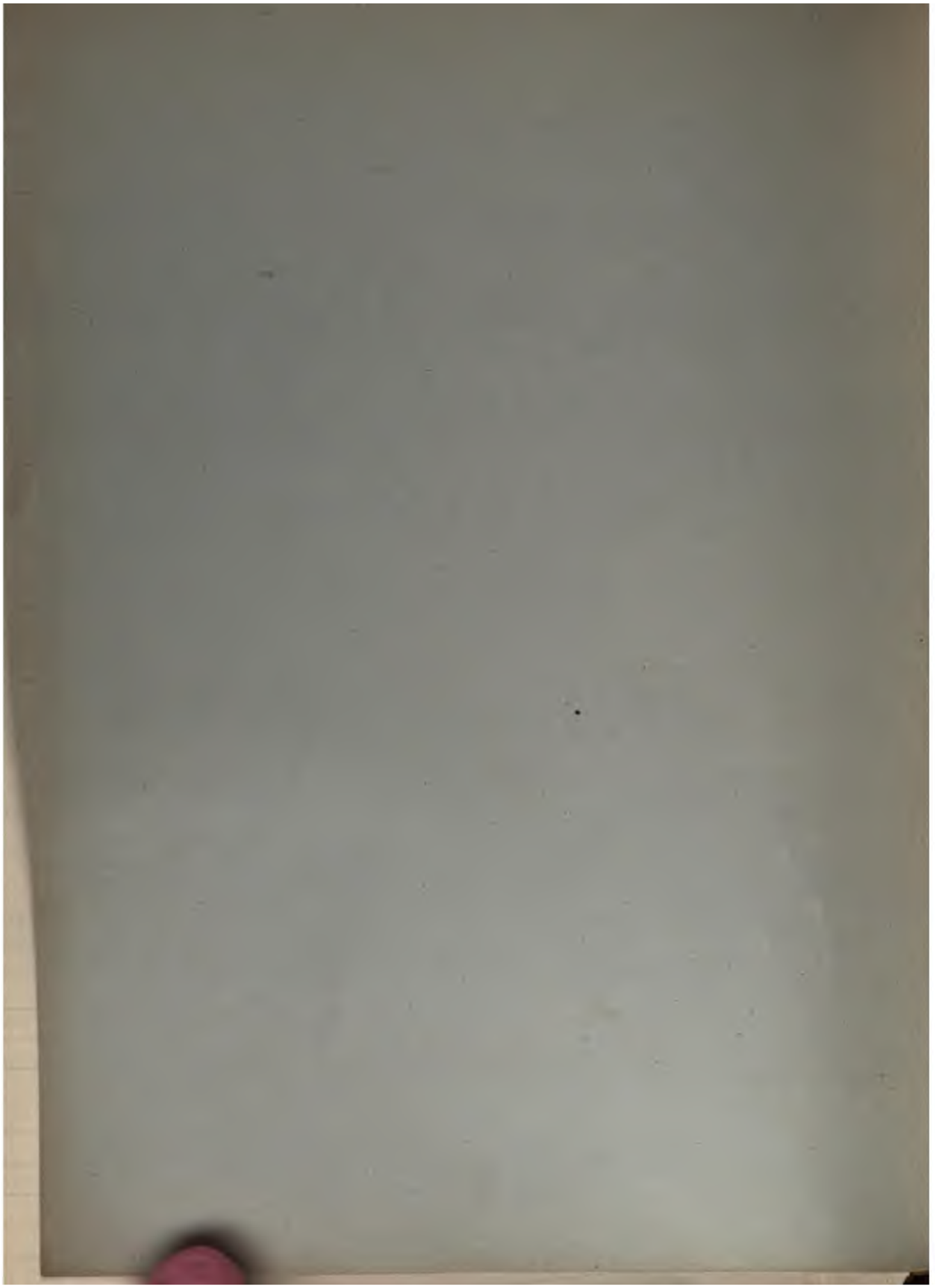

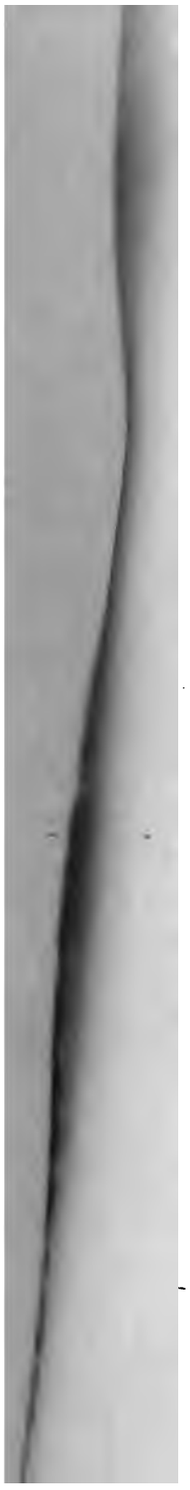

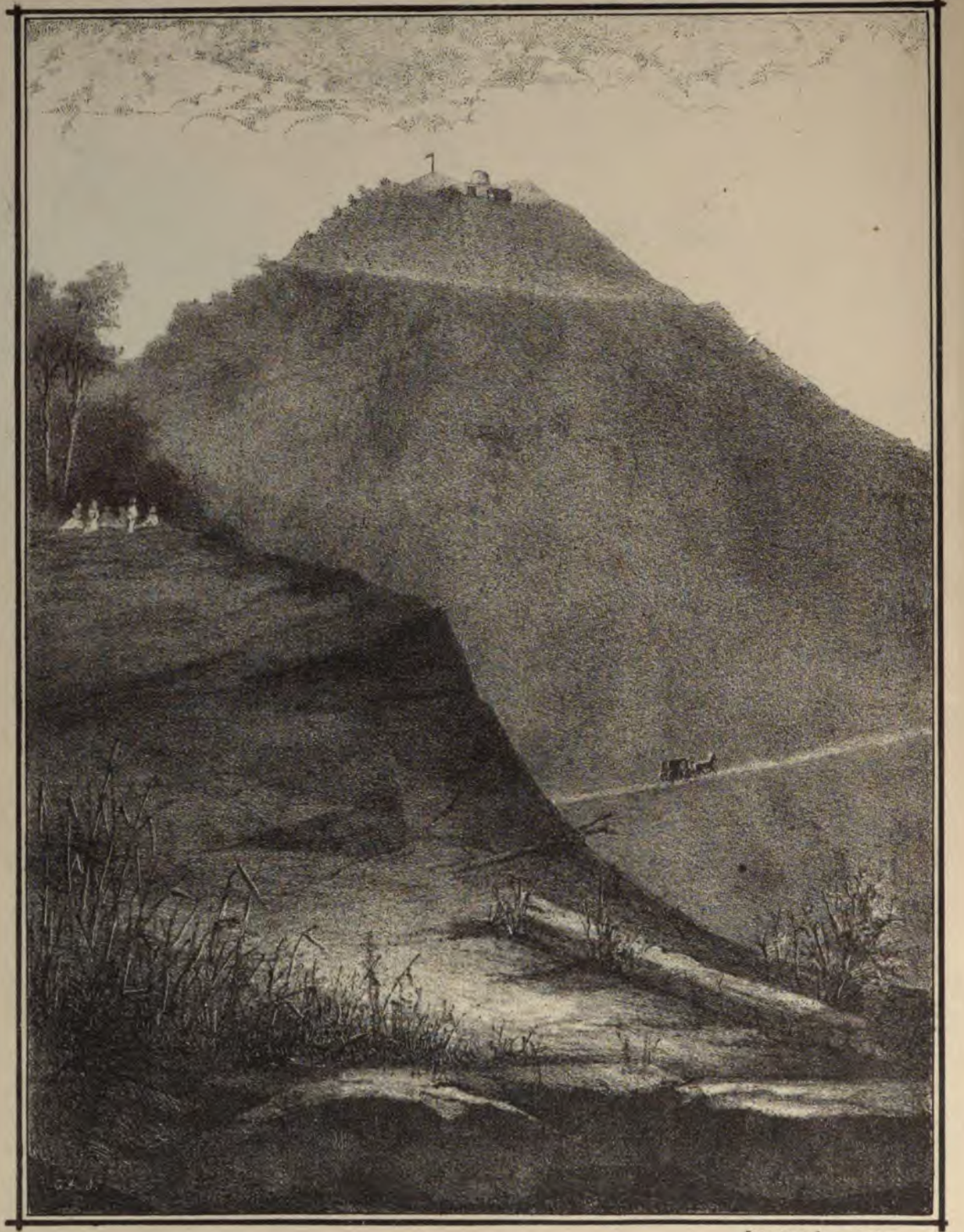

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Mt. HAMILTON.

AS SEEN FROM A POINT 500 FT. BELOW ITS SUMMIT.

(1)

REPORT TO THE TRUSTEES

OF THE

"JAMES LICK TRUST"

OF

OBSERVATIONS MADE ON MT. HAMILTON

WITH REFERENCE TO THE

LOCATION OF LICK OBSERVATORY.

BY S. W. BURNHAM.

CHICAGO:
KNIGHT & LEONARD, PRINTERS, 105-9 MADISON STREET.
1880.

GENTLEMEN,

I have the honor to submit herewith a Report, giving the results of my investigations on Mt. Hamilton, during the months of August, September and October, 1879, with reference to the atmospheric and other conditions of the locality, which affect its adaptation for astronomical observations, and its fitness for the permanent location of the Lick Observatory; to which I have annexed the principal astronomical observations made during my stay on Mt. Hamilton.

Very respectfully,

S. W. BURNHAM.

To Messrs. RICHARD S. FLOYD,
WILLIAM SHERMAN,
EDWIN B. MASTICK,
CHARLES M. PLUM,
GEORGE SCHONEWALD.
} *Trustees of the "James Lick Trust."*

REPORT.

In accordance with an arrangement made with the trustees of the James Lick bequest to make a series of astronomical observations for the purpose of determining the atmospheric conditions of that location, with reference to its adaptation for the proposed Lick Observatory (originally suggested by Prof. Edward S. Holden, in 1874, and subsequently approved by Prof. Simon Newcomb, in 1879), I left Chicago on August 10, 1879, arrived in San Francisco on the evening of August 16, and left for Mt. Hamilton the next morning in company with Capt. Richard S. Floyd, President of the Trustees. The summit was reached during the afternoon of the same day. The telescope, which was already on the ground, was hurriedly unpacked, temporarily set up in the observatory, and used that night.

SITUATION OF MT. HAMILTON.

The city of San Jose, the nearest point of railroad connection from Mt. Hamilton, is 50 miles south of San Francisco. Mt. Hamilton, by the highway, is 26 miles from San Jose, nearly east, and is reached by a good road constructed two or three years since by the county of Santa Clara. In order to keep the grade within the limit of six feet in one hundred, the last portion of the road is carried up the ridges of the mountain by a circuitous route. The distance between the observatory and San Jose, in an air-line, is only 13 miles.

The approximate geographical of the Observatory Peak is:

Longitude, - - - - - - - - -	121° 36′ 40″ W.
Latitude, - - - - - - - - -	37° 21′ 3″ N.

The elevation of this point is 4,250 feet above the level of the sea. The north peak, which is about three-fourths of a mile distant, is 140 feet higher. The ridge between is 00 feet, along which is a good trail connecting the two peaks. The sides of the mountain, in most directions, are very steep, and form an acute angle at the summit. The view from the peaks is unobstructed in every direction, there being no higher ground within a

radius of 100 miles. In this connection the report of Messrs. Herrmann Bros., the engineers who surveyed the road, will be of interest:

"The scope of the horizon from Mt. Hamilton takes in more ground, according to Prof. Whitney's judgment, than almost any similar peak in the United States, there being no obstruction to the view from any quarter. It is remarkably free from fogs and clouds, as we had ample occasion to observe during our last winter's stay on the mountain when locating the road. The bearings of the most notable objects are as follows, the distances being taken, when out of our county, from our most reliable maps:

Mt. Loma Prieta,	S. 35°	5′ W.,	19½ miles.
Mt. Thayer,	S. 51°	18′ W.,	19¾ "
Mt. Poucher,	S. 38°	35′ W.,	6 "
Block Mountain,	S. 87°	W.,	27½ "
Mt. Tamalpais,	N. 51°	20′ W.,	66 "
Mission Peak,	N. 47°	55′ W.,	16 "
Mt. Story,	N. 25°	45′ W.,	10¼ "
Mt. Diablo,	N. 21°	45′ W.,	39½ "
Mt. Santana,	S. 37°	E.,	35 "
Murphy's Peak,	S. 6°	5′ W.,	15 "

"None of these points reach the altitude of Mt. Hamilton. Of those within a radius of 20 miles the Loma Prieta reaches 3,800 feet; Thayer 3,550, and Block Mt. 2,800. All the rest are between 1,500 and 2,500 feet. Of the further peaks Mt. Diablo is 3,856.

"The formation of Mt. Hamilton, as of all the near surrounding ridges, is of trap rock. The high points, not worn down by the atmosphere and the action of the rain, are, therefore, very hard as soon as the upper crust is removed. In building the road we struck this hard rock at six or seven points on and near the cone, with a good prospect of finding it continuous and getting harder in the same proportion in going deeper. It has broken through the older formations at several points, near the base of the mountain, where it shows the same character, only intensified. At the top it appears as a greenstone porphyr, with small larkspur veins, exceedingly hard, without any defined strata, but in large boulders worn smooth, and generally flat on one side, and cemented together by other material less hard and easier to work. At a great many places the metamorphic slate, uplifted by the later upheavals, shows in considerable bodies, one of them being on the south side of the Observatory Peak, and nearly opposite one of the hardest points of porphyr."

At sunset the Pacific Ocean is seen over the summit of the coast range at various points; and occasionally a snow-covered mountain was seen in a

northerly direction, supposed to be Lasson Butte, the distance of which is about 175 miles. The great range of the Sierra Nevada, about 130 miles distant, came out sharp and distinct at sunrise. There were many very distant peaks in the east and southeast which could not be conveniently identified. As an illustration of the transparency of the atmosphere, I may mention a fact communicated to me by Prof. Davidson, of the U. S. Coast Survey. He was at work in the Sierra Nevada, at an altitude of over 10,000 feet, and was able to see with the naked eye the five-inch mirror of a heliotrope 175 miles distant.

INSTRUMENTS.

The six-inch refractor, by Alvan Clark & Sons, which I have used in nearly all my astronomical work, was taken to California for this purpose. It is equatorially mounted with circles and driving-clock. The eye pieces give powers up to 400. It is hardly necessary to say, in view of the large number of difficult stars discovered with this instrument in the last six or eight years, that it is first class in optical perfection, and fully up to the high standard found in the object glasses furnished by these manufacturers.

A set of meteorological instruments for temperature and humidity were furnished from the San Francisco office of the United States Signal Service, by direction of the Secretary of War. Two barometers, one a large aneroid by Negretti & Zambra, graduated to hundredths of inches, belonging to myself, and the other a standard mercury by Roach, of San Francisco, the property of Capt. Floyd, were used for ascertaining the atmospheric pressure. An anemometer, of great delicacy of movement, for showing the velocity of the wind during short intervals, was used when it seemed desirable to do so.

The observatory, prepared and put in place some time previously, although only intended for temporary use, is worthy of special mention, as it combines some novel features in its construction which might well be adopted in permanent structures of moderate size. The dome, 12 feet in diameter, is spherical, the skeleton frame being made of ¾-inch gas pipe, screwed to the bed of the dome and firmly fastened together at the center above, with an opening 2 feet in width for using the telescope. The whole, with the exception of the shutter, is covered with heavy canvas, made waterproof by two or three coats of paint. This covering was made of the right size and shape, and then lifted bodily on to its place. When lashed at the bottom and to the sides of the shutter, it made as complete and perfect a protection for the instrument, and was as convenient to handle, as could be desired. The opening is covered by a canvas flap. For the first month or

more the shutter was not closed at all, day or night, and during the whole visit perhaps not more than half a dozen times. The dome moves upon 12 iron balls, about 4 inches in diameter, in a cast-iron track on the walls of the building, with a corresponding groove in the castings attached to the lower side of the frame of the dome. The walls or sides of the building, 6 feet high, were made in 16 panels in order to be readily transported, and these plane surfaces were bolted together and to the circular track above. The dome was easily turned by reaching up and taking hold of it with the hand. The pier for the telescope was made of brick, commencing a few inches below the surface of the ground, and surmounted by a block of granite weighing about 150 pounds, to which the lower plate of the stand of the instrument was firmly bolted. This made as substantial a support as would be required for any purpose. The observatory walls were made secure by wire ropes, strongly anchored in the ground, and remained undisturbed during the whole time.

THE WEATHER.

I remained on Mt. Hamilton from August 17 to October 16 inclusive, and in that time was in the observatory every clear night, except September 21, 22 and 23, when I was absent at San Francisco. During the first 37 nights the seeing was first class on all occasions, with the following exceptions: August 21 and 26, the fog from the valley below reached the summit of the mountain and remained all night. On the 27th the fog lasted until about 10 P. M., and after that time it was clear, but only with what I have called medium steadiness; and the night of September 6, though clear, was of about the same character. As the seeing was first class for the 14 nights immediately preceding the 3 days I was absent, it is fair to presume the same conditions continued. We have then for the first 37 nights, 2 which were foggy, and 2 with only a fair quality of seeing, the others being strictly first class.

As the time for the commencement of the annual rains approached, a change was apparent in both days and nights, and occasionally there would be a cloudy night. The first rain-fall of the season occurred on the afternoon and night of October 6, and there was some rain on 4 days subsequently, but the whole amount was light. The kind of weather for astronomical purposes, during the whole period of 60 days, August 17 to October 16 inclusive, is briefly as follows:

First class nights,	42
Medium nights,	7
Cloudy and foggy nights,	11

In the first I have included the three clear nights referred to when the instrument was not used. There was not in the whole time a single poor night when it was clear. On only one occasion was there what would be called, in eastern observatories, bad seeing, and that lasted for perhaps an hour. It had been cloudy during the day, clearing up soon after sunset. For a little while after that the air was as unsteady as I have ever seen it anywhere; but it began to improve shortly, and later in the evening the definition was perfect.

By first class seeing I mean such a night as will allow of the use of the highest powers to advantage, giving sharp, well-defined images, and when the closest and most difficult double stars within the grasp of the instrument can be satisfactorily measured. Ordinarily on such a night an elongation of 0.″4 in stars down to the 8th or 9th magnitude would be detected independently with my instrument; and substantially all the stars in Struve's great catalogue, as well as those of the Herschels, would be easily picked up. A medium night is one when the seeing is of such a character that only moderate powers, say up to 200, can be profitably used, and when the severest tests would not be attempted. With a 6-inch aperture, measures then would not be satisfactory of stars having a distance of much less than 2″. In ordinary situations the clear nights would be divisible into at least four classes, which might be described as *very good, good or medium, poor,* and *very poor.* While there might be some difference in the nights on Mt. Hamilton I have described as *first class,* the difference seemed to be not sufficient to place any of them in a lower grade. The conditions were generally very permanent for the entire night, and this is not often the case in eastern localities where I have used a telescope. It may grow better, and may get worse, but rarely continues the same the whole night. On many nights, at Mt. Hamilton, I remained at the instrument until daylight, and so had abundant opportunities to observe this important fact.

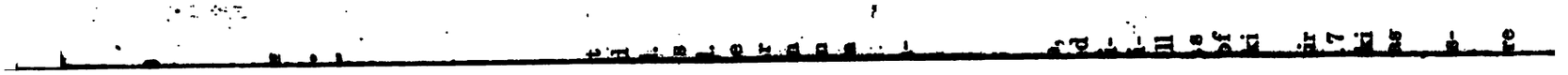
WIND.

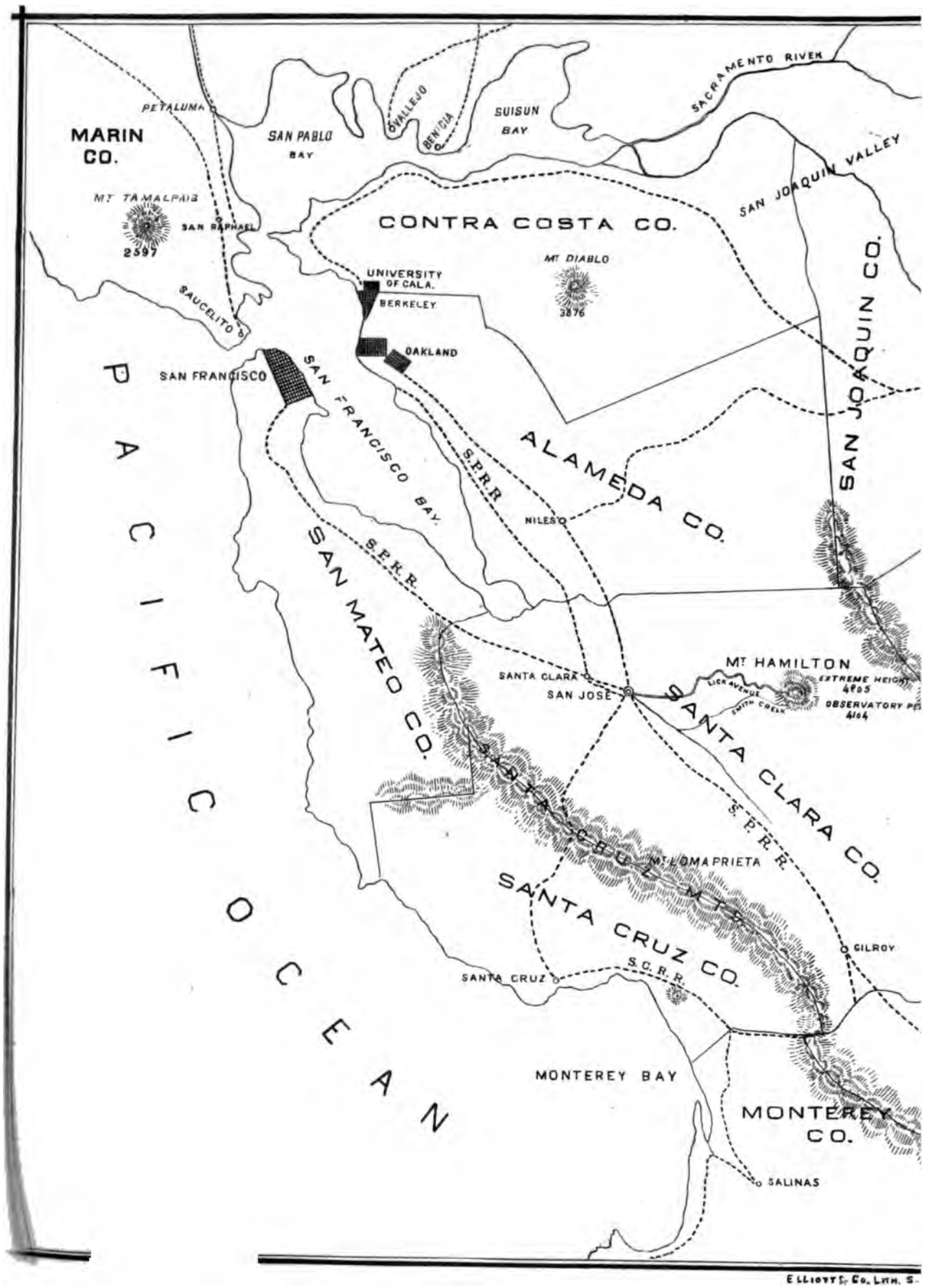
The prevailing wind at this season of the year is from the northwest, and only rarely it shifted to any other quarter. I had been led to expect much more disturbance from the force of the wind than was experienced during my visit. Many of the nights were perfectly calm and still, and at other times only a gentle breeze, such as might be expected in many much less exposed situations. Some of the time, however, a strong wind was blowing steadily, which, on perhaps one or two occasions when it was clear, reached a velocity

of 30 miles an hour. These conditions did not seem to affect the quality of the seeing, and did not interfere with the use of the micrometer when the opening of the dome was turned in the opposite direction. As already stated, the shutter, which extended from the zenith to the horizon, was left open all the time, and no anxiety was felt for the safety of the building. The only precaution taken was to leave the opening away from the northwest. It is proper to remark that a spherical dome offers great advantages in a locality like this. In the first place, it is impossible, whatever the violence of the wind may be, to blow it off. The greater the force of the wind, the more firmly is the dome pressed down on the walls; and secondly, the effect of the wind in shaking the instrument seems to be less when the opening is turned in some other direction, than in other forms of construction. There is, perhaps, no doubt that at some seasons of the year much severer winds are experienced, but some considerable portion of the time these winds would be accompanied by weather unfavorable for astronomical observations, and hence to that extent would not interfere with the use of the telescope.

HUMIDITY.

One of the most remarkable and interesting conditions observed is the dryness of the atmosphere. The average difference between the wet and dry bulb thermometers, for the first five weeks, was 18°.4, giving, by Blanford's tables, calculated for a mean barometer 25.8 inches, a relative humidity of about .27. During the last month, when clouds and fogs were more frequent, the mean difference fell to about 8°, giving an average humidity of about .61. The highest difference recorded was 30°, and a good many days it exceeded 25°. The lowest relative humidity was .06. I am inclined to attribute largely the remarkable steadiness of the air for astronomical purposes to this absence of moisture. I find, on examining the meteorological record, that in every instance when the seeing was noted as only medium, there was an unusual amount of moisture in the air, the difference in the thermometer readings being only 6° or 8°, or less. Every night was first class when this difference reached 15° and upward. It would seem that the hygrometer in this locality is the most important, if not the only, meteorological instrument worth consulting for testing in advance the condition of the air for telescopic purposes. How far this may be applicable to other localities, where the difference never exceeds a few degrees, I am unable to say; but certain it is that observations for temperature, pressure, wind, etc., in most places, furnish no clue to what can be done with an instrument on any given night.





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The average daily maximum temperature in the shade, for the first 5 weeks, was 88°, and the minimum 64°. The thermometer at 9 P.M. would ordinarily be 12° or 15° lower than at 3 P.M.

In connection with the dryness of the air the heat did not seem to be excessive, and it was seldom uncomfortably warm in the shade. The extreme range of the barometer during this time was between 25.30 and 25.45 inches. During the last two weeks a much lower temperature was reached, on one occasion the minimum thermometer indicating 30°.

OBSERVATIONS.

Many celestial objects in all the different classes were examined with the telescope at different times, and if they are not all referred to here, it is for the reason that the observations would furnish no satisfactory evidence of what could be done at this place with a 6-inch object glass. The appearance presented by the moon, planets, nebulæ, etc., under high powers in a steady air, may be satisfactory to the observer who is familiar with them under other circumstances, but such observations would have no value in aiding others to form an opinion of how much could really be seen. There is but one class of objects by which the atmospheric conditions of a locality, or the perfection of an object glass or mirror, can be thoroughly tested, and a record made. This is by discovering, observing and measuring difficult double stars, and particularly those which are less than the theoretical separating power of the instrument, and those which are both close and unequal. It is well known what a first-class refractor of any given aperture will do in dealing with test objects. The catalogues furnish a great variety of stars suitable for this purpose, many of which I have examined and measured, as the accompanying observations will show. The value of this work, as bearing upon the question at issue, will be best appreciated by those who have had practical experience in this class of astronomical work.

I prepared a series of cardboard discs, with apertures increasing from one inch up to the full aperture of the object glass, and observed a great many familiar objects, cutting down the light until the small star was just distinctly visible. Most of these stars have been used for a similar purpose elsewhere, and are well known to astronomers as well as to amateurs having the smallest portable instruments. The advantage of these tests is, that the observations can be repeated by any one, at any place, with a large or small telescope. Some of these observations are remarkable, considering the difficulty of the objects, with much larger apertures, in other localities. I am

confident that μ^2 Herculis, α^2 Capricorni, etc., have never been seen before with so small an object glass. They have always been beyond the reach of my instrument in Chicago.

Some of the more interesting experiments of this kind are as follows:

1879.641. μ^2 *Herculis.* Close pair very fairly seen.
.644. θ^2 *Orionis.* Fifth and sixth stars very plain, 4½ h. from the meridian.
.647. α^2 *Capricorni.* Companion plain with aperture contracted to 4 inches; difficult with 3½. Companion double with full aperture.
.647. *Vega.* Difficult with 2½ in.
.647. α *Cassiopeiae.* Companion plain with 1 in.
.647. η *Cassiopeiae.* Easy with 1½ in.
.647. α *Aquilae.* Easy with ⅓ in.
.647. β *Aquilae.* Difficult with 5 in.
.647. β *Delphini.* Struve's companion with 2 in.
.647. μ^2 *Herculis.* Close pair difficult with 5 in.; fairly seen with 6 in.
.657. ζ *Herculis.* Well seen with 3½ in.
.666. θ^1 *Orionis.* Fifth and sixth stars well seen with 3½ in., 2⅓ h. from the meridian, and the fifth with 3 in. The sixth only by glimpses.
.666. β *Leporis.* With 4 in., 2 h. from meridian.
.681. β *Orionis.* With 1½ in., 3 h. from meridian.
.681. θ^1 *Orionis.* Four stars easy with 1 in., 2 h. from the meridian.
.692. θ^1 *Orionis.* Fifth and sixth stars with 3 in., nearly 2 h. from the meridian.
.692. β *Orionis.* With ⅓ in.
.703. μ^2 *Herculis.* Well seen with full aperture and the angle of the close pair measured.

MICROMETRICAL MEASURES.

The position micrometer, made to order for double star work by a prominent London optician, requires special mention. As originally made, it probably combined more features which should be avoided, and so far as I know always have been, in an instrument of this kind, intended for actual service, than were ever found in any other micrometer in any age of the world. Some of the most objectionable peculiarities were:

I. No provision whatever was made for illuminating the wires.

II. The system of wires could not be moved independently for bringing them up to the star, the observer having to depend entirely upon the slow motion given to the clock.

III. The method of registering the revolutions of the screw was very faulty, as frequently the observer, in repeating a measure of distance, could not avoid knowing where the wires were placed in the preceding measure,

so that the measures would not be independent when the movable wires happened to be near the beginning or end of a revolution.

IV. The position circle was so placed and graduated that it was usually necessary for the observer to partially or wholly leave his seat to read off the angles, a very inconvenient thing to do in some positions of the instrument, to say nothing of the loss of time.

V. There was no lateral motion to the eye-piece. Though not indispensable, this is a very convenient arrangement, and one found in all good micrometers, as it enables the wires, when separated, to be placed at equal distances from the center of the field, and practically doubles the diameter of the field of each eye-piece for the measurement of distances.

VI. The eye-pieces furnished with the micrometer were found to be decidedly inferior to those made by Clark for the telescope, particularly in the examination and measurement of very difficult objects.

These were some of the more important defects, and, as far as they were foreseen, they were remedied before leaving Chicago. All the necessary changes and improvements, if embodied in the original construction, would not have increased the cost of the instrument to any appreciable extent. The micrometer had been in my possession for some time, but had not been used, for the want of a driving clock, and for about two years the equatorial had been dismounted. All of my micrometrical work has been done at the Dearborn Observatory. A new driving clock was procured, and applied for the first time to the 6-inch on Mt. Hamilton. Some of the defects specified were corrected. A bisecting screw was placed on the opposite side of the micrometer screw, and the whole frame placed in guides, so that the star could be at once brought up to the wire and kept there. This movement is certainly indispensable in all measures of distance. An independent motion was also given to the eye-piece. A new means for registering the number of revolutions of the screw was attached, which moved continuously, instead of only at the end of a revolution. In practice these changes and improvements proved satisfactory. The greatest difficulty arose from the illumination of the wires. Before leaving Chicago the adapting tube was cut away so as to throw the light of the lamp on the wires of the reflection from the inner surface of the tube; and this, in practice, not answering the purpose, additional apertures were made allowing the light to strike the wires directly. A great many experiments were tried, but the awkward and unusual construction of the micrometer made it impossible to get the light from just the right angle to produce satisfactory results, particularly when a high power was used on a close pair. There was no difficulty in getting light enough to

see the wires, but it was not the right kind of illumination for accurate measures of distance, and nothing I could do would make it so. To be sure a bright field could be made without reference to the construction of the micrometer, in this respect, and this was used some of the time; but I have always found the best results obtainable from the other method, and many of the stars, particularly the new pairs, from the faintness of the companions, could be seen in no other way. Hence the distances measured are far from satisfactory, though the angles would not necessarily be affected. The use of the micrometer under these discouraging circumstances was finally abandoned, but not until it had been sent to San Francisco twice, and much time had been spent in trying to make it work in a proper manner.

I allude to this more particularly because I had planned to make at least a thousand measures of specially interesting stars, and was exceedingly disappointed in having to give up this work. If this exasperating annoyance had been anticipated, I should have been prepared with a proper instrument made by the Clarks, with which the projected measures could have been agreeably and accurately made.

NEW DOUBLE STARS.

It is evident that the most satisfactory and conclusive proof of the quality and kind of seeing would be furnished by the discovery of new stars. Whatever advantage might be supposed to exist in the observation of familiar objects, from knowing where to look for a difficult star, would certainly be wanting in discovering and fixing the position and distance of a star never before seen. Partly for this reason I gave some time to an examination of the heavens for the detection of new double star systems, and particularly to that portion lying more than 30° or 35° south of the celestial equator. Most of the time was spent in the southern zones, as that to me was a new heavens, and the most promising field for such research. The result is very gratifying, and furnishes some of the most interesting discoveries, and among the prominent and well known stars; and at the same time shows the wonderful purity and steadiness of the air almost down to the very horizon. It might be supposed there would be little left to do, at least for a small instrument, among the naked eye stars, even in the southern hemisphere, and particularly when at Mt. Hamilton these stars had to be observed within a few degrees of the horizon. Sir John Herschel had traveled over this whole field at the Cape of Good Hope, where these stars were nearly overhead, with his "20-foot reflector," giving nearly ten times the

light of the Mt. Hamilton glass; and one not familiar with what large reflecting telescopes have done, and have failed to do, might suppose that but little would be left for discovery, at least among the large stars. So far from this being the case, the fact is, that almost nothing has been done in this great department of discovery and work by any observer in the southern hemisphere. It is a work which requires too perfect an instrument to be successfully undertaken by any of the large reflecting telescopes heretofore used. The catalogues of Herschel contain very few first class objects, the great proportion being very wide, insignificant and easy pairs, suitable as tests only for the smallest refractors. Fortunately a zone of 15° or 20°, too far south for any other American or European observatory, can be observed at Mt. Hamilton, and it is to be hoped that the work now commenced will not be neglected when the new observatory is established. In the meantime these stars will remain for the most part unobserved, since but very few of them can be sufficiently well seen at Chicago, or at any of the northern observatories, unless some one in the southern hemisphere, with a suitable instrument, shall take hold of the work.

The small refractor on Mt. Hamilton has divided again the principal components of several wide pairs previously catalogued by Herschel, Struve and South, transforming a wide pair into a close triple. The following are the stars of this class, with the approximate distances of the old and new companions:

	OLD STARS.	NEW STARS.
H 5028	35″	1″2
H 3644	40.	0.6
H 3875	20.	1.0
S 423	28.0	0.5
Σ 157	12.4	0.8

These, with the exception of Σ 157, are southern objects, and by no means the most difficult of the new stars, but they will show some of the advantages of a good instrument in a good place.

In regard to the northern new stars, it is sufficient to say that some of them are excessively difficult, and make excellent tests for the condition of the air. Good weather and good definition are as necessary in observing such stars with a large instrument as a small one. After my return to Chicago, I examined Σ 157 with the 18½-inch refractor of the Dearborn Observatory, and the first night nothing could be done with it; the large star did not appear to be double at all. Subsequently, when the air was better, it was well seen and measured carefully on two occasions. These

northern pairs are as favorably situated for all observatories in the northern hemisphere as for Mt. Hamilton, and the most of them will be found to be difficult with apertures much larger than six inches. I would call the attention of observers particularly to Nos. 736, 745, 749 and 774 of the annexed catalogue.

Of the new double stars, the following are visible to the naked eye, and some of them prominent and well known stars. Four of these were found on the last night of my stay on Mt. Hamilton.

η Sagittarii
θ^2 Microscopium
δ Piscis Australis
σ^2 Gruis
γ Caeli
λ Canis Majoris
x^3 Sagittarii
Argus 101
La Caille 1477
La Caille 2350
La Caille 8809

Besides these, a great many known double stars were picked up independently, both north and south. In fact, most of the closer stars in the southern zone, previously observed by Herschel and others, down to $-45°$ Decl., were found on different occasions.

These new stars will show, better than anything else can, what may be done at Mt. Hamilton. Remembering that they were discovered with what, in these days of great refractors, would be considered as a very inferior instrument in point of size, we may form some conception of what might be done with an instrument of the power of that at the Naval Observatory at Washington, having a light-power about nineteen times as great, or with the proposed Pulkowa glass of twenty-five times the power.

DAYLIGHT OBSERVATIONS.

A great many objects were examined by daylight, but the air, during the greater part of the day at least, appears to be no steadier than would ordinarily be found elsewhere. The heat of the sun, during the warmer part of the season, produces a disturbance of the air which disappears very soon after sunset. The sun planets and double stars were frequently looked at and some measures of double stars made. Double stars like ε Bootis and ε Lyrae could be very easily seen. The fifth and sixth stars of the trapezium

of Orion were beautifully seen in broad daylight just before sunrise. The sixth star was measured on this occasion without artificial illumination, and continued to remain visible as long as it was looked at, which was up to within seven minutes of the actual appearance of the sun above the horizon. The daylight measures will be found in the annexed catalogue. Venus was readily seen with the naked eye at any hour of the day, and easily found without an instrument to indicate the place.

CONCLUSIONS.

So far as one may judge from the time during which these observations were made, there can be no doubt that Mt. Hamilton offers advantages superior to those found at any point where a permanent observatory has been established. The remarkable steadiness of the air, and the continued succession of nights of almost perfect definition, are conditions not to be hoped for in any place with which I am acquainted, and, judging from the published reports of the various observatories, are not to be met with elsewhere. The low altitude at which observations can be made is a matter of no small importance, particularly in connection with the portion of the southern sky not ordinarily accessible to observatories in the northern hemisphere. The ease with which difficult objects can be seen almost down to the horizon will be apparent from the southern declination of many of the new double stars. Close pairs can be observed at least down to 43° South Declination. The permanent steadiness of the air during the whole night will greatly increase the amount of telescopic work over what could ordinarily be done on good nights in most places. An examination of my observations at Chicago during the summer of the present year shows that the good seeing very rarely continued the whole night, even when it remained clear, and this has generally been the case heretofore. In many instances the conditions favorable for the observation of the most difficult objects would only last an hour or two, sometimes occurring in the first part of the night, and sometimes not commencing until after midnight. On Mt. Hamilton there is but little variation of any kind during the dry season. Each day was very much like every other day, and, as already shown, the same statement would apply equally well to the nights. Apparently there is but little to be feared from the ocean fogs, as they seldom reach this elevation. Nearly every night, commencing at or soon after sunset, this fog comes in from the Pacific at the Golden Gate on the north, and the Bay

of Monterey on the south, and covers the whole valley, between the base of Mt. Hamilton and the coast range, with a dense mass of vapor, resembling, when seen from above, a great white sea, the tops of the lower hills standing up through it like islands. Ordinarily it is perhaps 2,000 feet lower than the summit of Mt. Hamilton. It does not appear to have any effect on the seeing so long as it is below the summit.

What has been said about the advantages of Mt. Hamilton for astronomical purposes, is of course based upon what was seen during the time spent on the mountain. This was my first visit to the Pacific coast, and hence I have no personal knowledge concerning other seasons of the year. From inquiries in various quarters, I am satisfied there was nothing about this season unusual, and there seems to be every reason for supposing, as the same cloudless sky and dry air prevails from about March until the commencement of the rainy season, near the close of the year, that the whole of this interval would be equally favorable for the use of the telescope. How much may be expected in the way of good weather during the less favorable part of the year, I am not able to express an opinion concerning, and it is very doubtful if much could be learned about this matter in any way short of an actual residence on the mountain; and it is probable that meteorological observations at the stations occupied by the signal service, and in the valley generally, would be of little use in determining this. The clear nights closely following rain-storms might not be first class, but with an interval of a few days, good nights might be expected. This was the case in the latter portion of my stay, and the last night on the mountain was as good as any which preceded it, as will appear from the catalogue of new stars.

After returning to Chicago I addressed a note to Prof. George Davidson, of the United States Coast and Geodetic Survey, requesting such information in regard to other seasons of the year as he would be able to give from his long residence on the Pacific coast, and paticularly from his opportunities of observing the atmospheric conditions at high altitudes. His kind response is very valuable evidence in this connection. I take the liberty of quoting the following:

"During our rainy season we have frequent short intervals of beautifully clear weather, generally with north or northwest winds, probably three days out of seven on the average. In such weather the 'seeing' would gladden your heart. During the last four days I was at Petaluma [this letter is dated November 26], and saw the companion of Polaris readily with an ordinary

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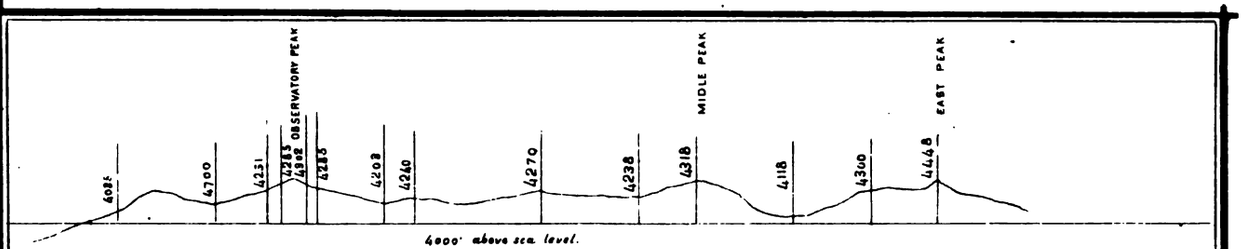

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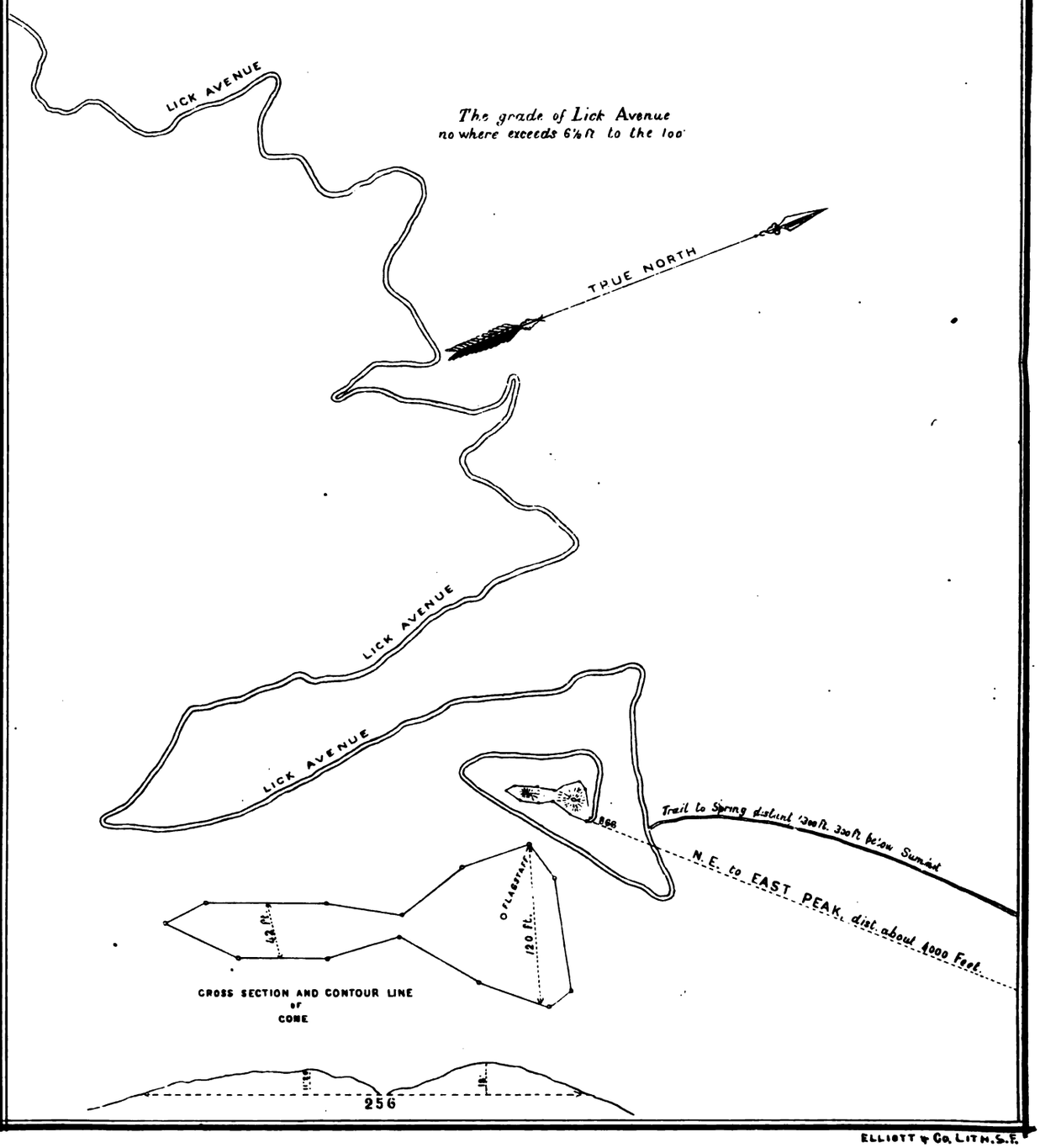

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3-inch objective; Saturn's rings were very sharply defined, and also Mars, and Jupiter and his satellites, yet I was at only 200 feet elevation.

"Some seasons are very rainy, and December and January have occasionally from 5 to 8 inches of rain each, but this is not the rule. There is generally an interval of clear, pleasant weather about the middle of the rainy season, reaching 20 days in some years. The best I have experienced has been in the latter part of January and the early part of February. Generally the winter dry weather is colder than the wet weather, but on the coast range the thermometer will rarely run below 20°.

"On the Sierra Nevada the clear weather of winter is something remarkable, for the marvelous sharpness of outline and the steadiness of images can be no better. I have to-day a letter from one of our officers saying that at 11,000 feet he had the thermometer in a snow-storm at 2°, but when it cleared up 'the seeing was splendid'; the heliotropes were dots of light on the contour of the mountains. Disregarding the discomfort of the storms, this is the time and weather for observation."

"So you see that other observers verify what I have been experiencing for 29 years. After you left there was a period of 15 days in the mountains of the most brilliant and uninterrupted seeing at our station on the Sierra.

"Some years since (about 1871 or 1872) I made a report to the Superintendent of the Coast and Geodetic Survey upon the weather statistics at 'Summit' Station, 7,150 feet high, on the Central Pacific Railroad, where it crosses the Sierra, and my recollection is that there were recorded in 1865–6 or 1866–7, 280 clear days and nights out of 354, with the thermometer, two or three times, just below zero. On the southern coast I have observed 56 nights out of 60 during summer and fall!

"In the dry season the best observing is at the close of the wet season, say from March 1 to June or July. After that time the smoke of the great valley and the heated air on the San Joaquin side of the coast range, and the chilled air and strong winds on the ocean side, combine to give unfavorable conditions of seeing. I should not expect to get the best seeing in August and September, unless as an exceptional case.

"I should say that on the higher peaks of the coast range (over 3,000 feet), or in the Sierra Nevada, or on San Bernardino, at 10,000 feet, the astronomer may be sure of 250 good nights every year, and that 150 of those nights will be such as are rarely ever experienced at the east. The stars, the planets, the moon, the sun, and the nebulæ, are absolutely new presentations to the observer, and are capable of the most searching and minute measurements. Moreover, at the great heights the thermometer will

seldom fall below zero, and having weathered two Sierra storms of wind and snow, at 10,600 feet, in a markedly exposed situation, I am sure that an observatory would be as perfectly safe there as at lower elevations.

"There is of course more moisture in the atmosphere in the wet season; but when the sky clears up and the northerly wind blows, it is a dry wind, and the outlines of everything visible are wonderfully sharp, distinct and steady. In October I could readily pick out the principal characteristics of the trees on Mocho (near Mt. Hamilton) at 120 miles.

"On the coast the 'fogs,' do not rise to a greater elevation than 2,000 feet, and that very rarely; their average height is 1,500 feet, and they get as low as 1,300 feet,— that is, the upper surface. This I have determined when occupying stations on the seaboard mountains. On Hamilton, Diablo, or Helena, or any other coast-range mountains, you will not have any fog in winter, but you may be in a cloud which envelops the mountains, and which comes up with the southeast winds and rains. In winter we have no 'fogs' as we have in summer; occasionally one may form, but not as the summer fog does."

This interesting and valuable communication throws much light upon some important questions, which, from the short time covered by my observation, could not be considered. But if nothing could be done in the winter, and the nights were as favorable throughout the dry season as I found them, Mt. Hamilton would be much more desirable, and more could be accomplished there with a large telescope than at any other place where an observatory has yet been established. So far as there have been opportunities for judging, it is obviously an appropriate place for erecting and maintaining the telescope to be constructed under the Lick deed of trust, and required to be "superior to and more powerful than any telescope ever yet made." With such an instrument in such a field, wonderful discoveries may be made. The only limit to the size of the object glass would be found in the mechanical difficulties attending its construction. No refractor that can be made in the present state of the art would be unsuitable, so far as the observed conditions would enable one to judge. It is impossible to overestimate the great discoveries which might be made, and the important work done with a first-class object glass of thirty inches or more aperture, as perfect in all respects as the instrument at the Naval Observatory at Washington. In addition to the main telescope, the observatory should be provided with at least one smaller equatorial of ten to fifteen inches aperture, with which in this place most of the ordinary

work of an equatorial elsewhere could be done, leaving the large instrument to be devoted to special work.

I wish, in conclusion, to express to the trustees of the Lick bequest my acknowledgments of the many personal attentions I received from them, and especially to Capt. Richard S. Floyd, the president of the board, to whom was committed the arrangements connected with my visit to Mt. Hamilton. Nothing could exceed the liberality and promptness with which every needful provision was made for the prosecution of the work, and for my personal comfort. I was fortunate in having, during most of the time, the companionship and assistance of Mr. Thomas E. Fraser, the business agent of the trustees, whose intelligent interest in the object of the investigation, and executive ability, rendered efficient assistance, and relieved me from many cares and responsibilities. I am also under obligations to the citizens of San Jose for many courtesies and kind attentions.

To the officers of the great railways connecting the Northwest with the Pacific coast, the Chicago, Burlington & Quincy Railroad, the Union Pacific Railroad, and the Central Pacific Railroad, special thanks are due for their generous coöperation in furnishing free transportation over their respective lines.

S. W. BURNHAM.

CATALOGUE OF FORTY-TWO NEW DOUBLE STARS,

DISCOVERED AT MT. HAMILTON.

The number in the first column is continued from the preceding series of catalogues of new double stars, the present list being the eleventh in order of publication.

No. β	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
		h. m. s.	° ′	°	″			
734	Ceti 132.....	0 46 47	−24 39	347·0	11·49	6..10	·675	
				353·3	10·59	6..12	·681	
				346·5	10·14	6..11	·692	
735	.....	0 58 55	−34 10	216·1	8·53	7·0..11·5	·675	
				220·6	8·75	7·0..11·5	·692	
736	Σ 157.....	1 39 38	+38 20	206·0	0·96	8·5..11·0	·862	A and B
				207·7	0·74	8·3..10·0	·898	
				114·4	12·24	9·0.. 9·2	·854	AB and C
				117·2	12·56	8·3..10·0	·898	
737	.....	2 12 12	−31 17	202·1	3·47	7·7.. 8·5	·675	
				205·8	3·59	8·0.. 9·0	·684	
				204·1	.....	8·0.. 8·7	·692	
				206·1	2·22	7·8.. 8·5	·733	
738	La Caille 720..	2 18 5	−30 25	172·4	0·53	7·0.. 7·0	·692	
				192·9	0·76	8·0.. 8·0	·706	

734. *Ceti* 132. A large star with a very minute attendant. The principal star is Lalande 1477.

735. A moderately difficult pair. Place from Washington Zones, where it is called 6 magnitude.

736. Σ 157. The wide pair, A and C, is one of Struve's. The large star was suspected to be double on October 4; subsequently it was examined carefully, and the suspicion confirmed. On my return to Chicago, I looked at it with the 18½-inch of the Dearborn Observatory, but could not be sure of it even then on the first occasion. The next night it was well seen, and both companions measured, and measured again later. The results are given above. There is no evidence of change in the distant companion. Struve's measures of that are:

P=115°·5 D=12″·26 1832·9

The new pair is excessively difficult, and the best possible test for both illumination and definition, as the two stars are very unequal. To observe, or detect, such a pair, good atmospheric conditions are indispensable, no matter how large a telescope is employed. It is not likely to be seen anywhere else, without an aperture considerably exceeding six inches.

737. An easy pair. Not in La Caille or O. Arg. Place from Washington Zones.

738. A close and difficult pair. There may be an error in reading the position-angle in one of the observations. This is 6½ magnitude in La Caille. No. 739 is closely following.

No. β	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
		h. m. s.	° ′	°	″			
739	0¹ Arg. 1542...	2 19 33	−30 24	263·9	2·06	8·0.. 9·0	·675	
				262·3	2·20	.....	·684	
				267·3	2·13	8·3.. 8·5	·692	
740	β 307	2 40 29	+29 41	110·±	0·3±	7·5.. 7·5	·711	
741	S. 423.....	2 51 58	−25 27	152·6	0·66	7·8.. 7·8	·689	A and B
				156·2	0·43	7·5.. 7·7	·692	
				158·6	0·50	7·5.. 8·0	·701	
				165·3	0·69	8·0.. 8·0	·703	
				221·0	28·62	8·0	·692	A B and C
				221·9	27·03	7·8	·701	
742	.....	3 17 ±	+48 50:	.....	.....	8	.....	
743	Arg. (51°) 802.	3 46 36	+51 54	260·±	1·2±	8·2.. 9·0	·747	

740. (β 307.) With this instrument, in 1874, I detected a minute star about 15″ distant, in the direction of 315°, and it was afterward measured by Baron Dembowski, by Prof. Hall with the Washington 26-inch, and by myself with the Chicago 18½-inch. On several occasions, on Mt. Hamilton, I suspected the large star to be a very close double. It seems impossible it should have been overlooked with the great refractors mentioned above, and possibly the supposed elongation may not be real, but it should be carefully examined before being rejected. If a night sufficiently perfect can be found, I hope to try it with the 18½-inch, and give the result before this catalogue is printed.

741. (S. 423.) This wide pair has long been known. It was first observed by Sir James South, and subsequently by Sir John Herschel, at the Cape of Good Hope, Jacob, Powell, Dunlop and others. There is no evidence of material change, as a comparison of some of the measurements will show.

	°	″	
South, . .	P=219·1	D=27·75	1824·9
Herschel, .	221·3	28·62	1835·9
Jacob, . .	220·7	27·19	1846·8
Burnham, .	221·4	27·80	1879·7

With the 6-inch it was at once seen that the larger star of this pair was itself a close double. The mean result of the four measures is:

P=158°·2 D=0″·57 1879·7

742. Suspected to be a close pair, but not verified.

743. Rather a difficult pair of small stars, 2½′ north of the 6½ magnitude star, Lalande 7128.

No. β	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
		h. m. s.	° ′	°	″			
744	Eridani 299 . . .	4 16 32	−26 0	110·±	0·6±	6·5 .. 6·5	·747	A and B
745	Arg. (53°) 772.	4 19 10	+53 39	150·±	0·5±	8·5 .. 8·5	·753	
746	. . . . .	4 27 ±	−36 10±	30·±	1·2±	8 .. 9	·788	
747	Caeli 6	4 28 48	−38 32	240·±	2·5±	7·5 .. 9·5	·788	=La Caille 1518
748	. . . . .	4 47 14	− 7 53	129·7	0·99	9·0 .. 9·0	·684	
				133·2	1·07	9·0 .. 9·0	·689	
749	Arg. (55°) 958.	4 57 38	+55 22	225·4	0·70	7·8 .. 10·5	·733	
				226·4	1.12	8·0 .. 9·5	·742	
750	γ Caeli	5 0 5	−35 39	300·±	2·5±	4 .. 10	·788	
751	Arg. (42°) 1184	5 1 16	+42 31	270·±	5· ±	8·0 .. 10·8		
752	. . . . .	5 39 ±	+47 46±	. . . . .	0·5	8 .. 8	. . . . .	Suspected close-pair
753	λ Canis Majoris.	6 23 40	−32 30	40·±	1·2±	5 .. 8	·788	
754	La Caille 2350.	6 30 22	−33 55	20·±	0·5±	6·5 .. 7·0	·788	

744. *Eridani* 299. The principal star with two very distant companions was noted by Sir John Herschel, at the Cape of Good Hope, and is entered in that catalogue as H 3644. These two stars he describes:

P=20°±	D=25″±	1835·9	Mags. 6 . . . 14
37·5	40·±	1835·9	8

I find that the large star is a fine close pair, and in every respect a first-class object. Though missed by Herschel with the 20-foot reflector in the southern hemisphere, it is much easier than many of the new stars given in this list. This star is Lalande 8264.

745. A difficult and close pair of small stars. An excellent test.

746. A difficult southern pair. Place approximate, as it is not in the star catalogues I have. It is 17′ south, and a little following the wide pair, H 3659.

748. The double is the preceding of a small triangle of stars, all in the same field. Close and difficult.

749. A difficult pair near Σ 635. It is troublesome to see, from the inequality of the components.

750. (*γ Caeli.*) A splendid pair, and one that it would seem ought to have been found long ago in the southern hemisphere. This was discovered on the last night of my stay on Mt. Hamilton. Four other naked-eye stars were found to be double during the same evening. (See Nos. 753, 754, 755, 757.)

752. This star appeared to be a close pair.

753. (*λ Canis Majoris.*) A very fine pair of large stars, comparatively easy, for so prominent an object.

754. A close and difficult naked-eye pair. In La Caille 5½ magnitude. There is an 11m companion, 25″ distant in 40°.

No. β	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
		h. m. s.	° ′	°	″			
755	Argus 34	6 31 14	−36 41	250·0±	1·0 ±	6·0.. 7·5	·788	A and B
				300·0±	12·0 ±	11	·788	AB and C
756	.....	6 41 :	+39 35 :	.....	.....	8	.....	Suspected close pair
757	Argus 101	7 8 10	−36 20	60·0±	1·5±	6·0.. 7·5	·788	=La Caille 26
758	Lyncis 51.....	7 20 0	+48 26	110·0±	15·0 ±	6·0..11·2	·747	=Lalande 144
759	H 5028.....	18 3 54	−39 22	118·1	1·20	9·0.. 9·5	·681	A and B
				149·2	34·81	9·2	·681	A and C
760	η Sagittarii....	18 9 31	−36 48	101·7	3·48	3 ..10·5	·644	A and B
				99·2	2·44	.....	·675	
				99·4	2·75	11·5	·681	
				100·0	.....	11·5	·684	
				99·2	2·64	12·0	·695	
				303·1	93·22	10·5	·644	A and C
				301·3	95·54	10·5	·684	
761	.....	19 30 ±	−40 3±	198·1	1·59	8·0..10·5	·681	
				198·0	.....	8·0..10·5	·684	
				196·1	2·25	8·2..10·5	·687	
762	La Caille 8392.	20 9 21	−32 59	42·6	3·83	8·0.. 8·0	·717	
				20·7	2·39	8·0.. 9·0	·742	

755. (Wide pair=H 3875.) Herschel discovered the distant companion with the great reflector, and recorded:

P=295°·0 D=20″± 1837·9 Mags. 6...13

The large star proves to be a close and somewhat unequal pair. The small star was of course very plain.

757. This is also a naked-eye star, and a fine pair.

758. A star just visible to the eye (Heis 6-7m), with a faint companion.

759. (Wide pair=H 5028.) Herschel recorded the wide pair at the Cape of Good Hope as follows:

P=152°·5 D=20″± 1835·5 Mags. 9...9

The principal star is double, as given above. It is not difficult.

760. (*η Sagittarii.*) A beautiful pair, and always very well seen. Strangely missed by Herschel and other observers in the southern hemisphere.

761. I do not find this in any of the star catalogues I have referred to. The place is approximately correct.

762. Possibly some other pair was measured in the second observation.

No. β	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
		h. m. s.	° ′	°	″			
763	κ^2 Sagittarii ...	20 15 45	−42 48	28·6	1·23	7·0.. 8·5	·687	Lac. 8417
				19·9	1·25	6·5.. 7·0	·753	
764	.....	20 52 22	− 9 49	180·±	0·6±	9·5.. 9·5	·673	A and B
				161·2	0·6±	9·0.. 9·0	·684	
				170·6	0·5±	9·0.. 9·0	·706	
				112·3	100·61	9	·684	A B and C
				113·2	100·51	9	·706	
				21·3	140·55	9	·684	A B and D
				22·1	139·36	9	·742	
				90·7	.....	11	·684	A B and E
				321·5	.....	.....	·684	C and E
				175·7	.....	.....	·684	D and E
765	La Caille 8632.	20 53 13	−35 45	140±	2· ±	7·0..11	·736	
766	θ^2 Microscopium	21 16 49	−41 31	310·0	0·99	5· .. 6	·701	
				318·3	0·68	.....	·753	
767	La Caille 8809.	21 19 24	−43 4	147·1	4·70	5·0..10	·675	
				145·3	.....	6·0.. 9·0	·701	
				145·9	3·40	6·5.. 8·0	·753	
768	La Caille 8964.	21 48 33	−37 52	.....	.....	6	·641	
769	La Caille 9046.	22 4 37	−35 3	348·6	0·6±	7·0.. 8·0	·695	
770	Lalande 44060.	22 27 47	−23 13	360·±	1·2±	8·5..10·8	·753	
771	σ^2 Gruis	22 29 57	−41 13	270·±	1·3±	6·0..10·5	·641	

764. The close pair is the preceding star of a small equilateral triangle, all in the same field. The measures connect these with the double, and also a faint star, E. The close pair is very difficult, and, though considerably within the southern limit of Struve's great Catalogue of Double Stars, might easily be overlooked with a much larger telescope.

765. A difficult and unequal pair.

766. (*θ^2 Microscopium.*) A fine pair, and one rather difficult to measure in this latitude.

767. A naked-eye star. Measures of distance not very good. In La Caille, 6m.

768. When first observed there did not appear to be any doubt of duplicity of this star, but on one or two occasions later it was not well enough seen to be certain of. It is a large star, 2½ minutes following γ Gruis.

771. (*σ^2 Gruis.*) A beautiful pair under favorable conditions.

No. β	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
		h. m. s.	° ′	″	″			
772	δ Piscis Australis	22 49 18	−33 11	232·7	5· ±	5·5..12	·684	
				240·6	.....	12	·684	
				242·1	.....	12·5	·698	
				235·1	.....	12·5	·701	
				241·4	.....	.....	·750	
773	La Caille 9369 .	23 0 14	−39 33	.....	.....	6	·753	
774	Arg. (63°) 2006	23 25 18	+63 40	360·±	0·5±	8·5.. 9·0	·673	
775	La Caille 9234 ..	23 30 45	−32 32	252·8	6·74	6·5..11·0	·684	
				268·2	4·70	6·5..11·5	·692	

772. (*δ Piscis Australis.*) This star has a very minute attendant. It is near one of Herschel's pairs, γ Piscis Australis, but the latter, though unequal, is much easier.

773. This appeared to be a close pair, but the apparent vertical elongation may not be real.

774. An excessively difficult pair of small stars. This will be found to be a troublesome object with any moderate aperture.

775. The measures disagree so much that possibly they may belong to different objects.

NOTE.—**774.** After the foregoing was in type, I observed this pair with the 18½-inch Equatorial of the Dearborn Observatory, and made the following measures:

°	″		
P=7·9	D=0·44	8·5 . . 9·0	1880·573
4·6	0·54	8·3 . . 8·5	·581
7·8	0·55	8·5 . . 9·0	·592

ERRATA.—The contracted aperture given on page 10 for α Aquilæ should be 1⅛ inch; and in the second observation of β Orionis it should be 1⅓ inch.

No.	Double Star.	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
			h. m. s.	° ′	°	″			
1	Σ 3063	.....	0 1 28	− 5 13	222·4	.....	.....	·703	
2	S 384	.....	0 13 44	+37 34	17·5	62·12	7· .. 9·	·736	
3	H 3375	.....	0 26 0	−35 35	167·0	6·93	6·8.. 9·5	·681	
					166·4	6·86	7·0.. 8·5	·692	
4	H 1993	α Cassiop. ...	0 33 42	+55 53	280·2	61·33	.....	·711	
5	Σ 52	.....	0 37 31	+45 35	21·4	1·80	.....	·753	
6	0Σ 20	66 Piscium...	0 48 10	+18 32	180·0	0·44	5·6.. 5·6	·701	
					191·4	0.53	6· .. 6·	·703	
7	Σ 113	42 Ceti.....	1 13 41	− 1 8	348·7	1·04	6· .. 6·5	·709	
8	β 513	48 Cassiop. ..	1 52 7	+70 19	267·4	1·13	5· .. 8·	·644	
9	Σ 201	ε Trianguli ..	1 55 58	+32 42	118·1	.....	.....	·638	
10	ℍV. 102	61 Ceti.....	1 57 39	− 0 55	190·6	44·16	6· ..10·5	·709	
11	Σ 230	.....	2 6 28	+57 56	258·6	24·82	8·2.. 8·7	·709	
					258·2	23·85	8·0.. 8·7	·736	
12	Σ 231	66 Ceti.....	2 6 39	− 2 57	231·4	16.48	.....	·709	
13	0Σ(app)25	.....	2 8 29	+56 30	205·0	103·88	7·0.. 7·3	·681	
14	0Σ 42	.....	2 25 5	+51 47	.....	.....	.....	·666	
14a	Σ 281	ν Ceti.....	2 29 33	+ 5 4	260·4	8·81	5· ..10·5	·709	
15	0Σ(app)30	.....	2 32 35	+ 8 24	213·5	68·68	8·0.. 9·5	·681	
16	Σ 289	33 Arietis ...	2 33 40	+26 33	0·3	29·76	5· .. 8·	·736	
17	Σ 295	84 Ceti.....	2 35 4	− 1 12	327·3	4·44	5· ..10·5	·709	
18	Σ 296	θ Persei	2 35 59	+48 43	297·7	17·87	4·5..10·5	·709	

2. S 354. A decided change in the distance of this pair since South.

3. H 3375. Probably without change. H 167.°4 (1835.8).

6. 66 Piscium. A difficult pair in rapid orbital motion. It has been but little observed. The principal measures are:

0Σ	P=72°·8	D=0″·62	1847·8
0Σ	59°·9	0″·67	1860·3
De	37°·9	oval	1873·4
β	5°·7	0″·48	1879·7

14. θΣ 42. Measured by 0Σ in 1847, when the distance was 0″·4. De found it single in 1865, and on the present occasion it appeared perfectly round with the highest powers.

No.	Double Star.	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
			h. m. s.	° ′	°	″			
19	Σ 299	γ Ceti.....	2 37 5	+ 2 44	284·6	2·22	.....	·709	
					287·8	2·47	.....	·733	
20	H 3536	.....	2 44 0	−36 18	10·6	6·±	6·5..12·0	·675	
					9·1	.....	6·5..12·0	·692	
21	0Σ(app)31	.....	2 51·36	+59 11	229·1	72·95	7·8.. 8·2	·681	
22	Σ 333	ε Arietis.....	2 52 21	+20 52	196·9	.....	.....	·695	
					196·4	1·34	.....	·736	
23	β 525	B. A. C. 920..	2 52 0	+21 8	107·3	0·39	7·5.. 7·5	·695	
24	β 11	ρ' Eridani....	2 56 50	− 8 9	82·8	1·78	6· ..10·5	·733	
25	H 663	94 Ceti.....	3 6 37	− 1 39	252·9	3·28	5· ..12·5	·681	
26	H 3555	12 Eridani...	3 6 58	−29 28	318·2	.....	4· ..10·5	·684	
27	β 84	.....	3 10 5	− 6 22	27·9	0·56	7·2.. 8·5	·695	
28	β 535	38 Persei	3 36 47	+31 54	53·2	0·67	4· .. 7·	·695	
29	0Σ(app)39	.....	3 39 45	+56 45	74·9	58·24	7·0.. 7·3	·681	
30	Σ 464	ζ Persei	3 46 35	+31 32	205·5	12·71	3· ..10·	·706	A B
					287·2	33·49	..11·5	·706	A C
31	Σ 470	32 Eridani...	3 48 16	− 3 19	345·8	7·37	.....	·709	
32	Σ 460	.....	3 49 57	+80 22	31·8	0·90	7·0.. 7·2	·709	Binary
33	β 547	47 Tauri	4 7 25	+ 8 58	10·6	0·40	5· .. 8·5	·681	

20. H 3536. H gives 3°·5 (1835·8), 6...13.

23. β 525 Discovered by me with the Washington 26-in. in 1875. The only prior measure is with the 18½-in:

β P=105°·1 D=0″·59 1877·7

25. 94 *Ceti.* A difficult pair. The distance is too small. H called the small star 19 magnitude.

27. β 84. Probably a binary system.

De P=10°·3 D=0″·51 1875·8

28. 38 *Persei.* An excessively difficult pair, discovered with the 18½-in. in 1877. The measures with the 18½-in. give:

β P=56°·8 D=0″·83 1878·2

33. 47 *Tauri.* A fine but very difficult pair, discovered in 1877 with the Chicago 18½-in. A severe test for moderate apertures.

No.	Double Star.	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
			h. m. s.	° ′	°	″			
34	Σ 518	40 Eridani...	4 9 52	− 7 47	105·7	81·48	.....	·675	A B
					121·8	.....	.....	·675	B C
					124·3	3·64	.....	·681	
35	0Σ 82	.....	4 15 55	+14 46	179·4	0·54	8·5.. 9·2	·695	Rapid motion
36	Σ 9, app 1	$\varkappa'$ Tauri	4 18 12	+22 1	172·7	340·83	.....	·681	
37	Σ 562	.....	4 27 34	+22 27	274·4	.....	8·5.. 12·	·695	
38	Σ 2, app 2	α Tauri	4 29 2	+16 16	34·1	114·96	.....	·681	
39	Σ 599	.....	4 42 24	+44 46	336·8	11·33	8·5.. 9·0	·706	
40	Σ 602	.....	4 46 4	+69 6	133·7	31·00	8·5.. 9·0	·706	
41	Σ 604	.....	4 46 46	+69 52	39·3	.....	8·5.. 9·0	·706	
42	Σ 606	.....	4 47 29	+69 14	299·2	38·18	8·5.. 8·7	·706	
43	0Σ 95	.....	4 58 28	+19 38	335·9	0·53	.....	·701	
44	β 555	β Orionis....	5 8 47	− 8 20	130·±	.....	.....	·666	Seems elongated
					128·6	.....	.....	·681	Certainly elongated
					129·7	.....	.....	·681	Later, same night
					129·5	.....	.....	·684	Well marked
					123·0	.....	.....	·692	
					118·8	.....	.....	·695	
45	Σ 676	.....	5 13 4	+64 37	285·3	0·54	8· .. 9·	·703	
46	Da 5	η Orionis....	5 18 27	− 2 30	79·0	0·93	.....	·733	

34. 40 *Eridani.* One of the most interesting binary systems. For comparison we have:

Hl	P=105°·6	D=81″·87	1879·2
β	125°·4	3″·66	1879·0

44. *β Orionis.* The duplicity of the companion to this well known star was suspected in 1871. It was examined a great many times between this and 1878. During the early part of the last named year, what appeared to be a certain elongation was measured on three nights with the 18½-inch. The measures then gave an angle of about 170° with a distance not exceeding 0″·25. The measures given above do not agree with the prior observations, but the slight elongation seemed to be real, and I cannot think there is any mistake. This is the most difficult and troublesome star I have ever attempted to observe. (See *Monthly Notices, R. A. S.*, June 1878.)

No.	Double Star.	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
			h. m. s.	° ′	°	″			
47	β 320	β Leporis....	5 23 6	−20 51	291·2	.....	.....	·681	
					296·9	.....	.....	·684	Just before sunrise
					293·7	.....	.....	·695	
					292·0	2·62	.....	·701	
					285·8	2·05	.....	·733	
48	Σ 748	θ¹ Orionis....	5 29 23	− 5 28	120·2	4·21	.....	·684	Sixth star
					116·6	.....	.....	·695	
					119·5	4·44	.....	·733	
49	β 89	.....	5 31 29	− 1 30	4·0	.....	.....	·692	
50	Σ 774	ζ Orionis	5 34 42	− 2 0	147·8	2·27	.....	·733	
51	Σ 3115	.....	5 36 57	+62 46	24·1	1·14	7·0.. 7·5	·703	
52	Σ 784	.....	5 48 19	+84 12	193·3	1·37	9· .. 9·	·703	No measures since Σ
53	0Σ 545	θ Aurigæ	5 51 32	+37 12	359·5	1·66	3· .. 10	·703	
					365·8	1·86	.....	·709	
					367·1	1·89	.....	·733	
54	0Σ 159	15 Lyncis....	6 46 54	+58 25	8·4	0·82	.....	·703	Binary
55	Σ 1110	Castor	7 26 57	+32 9	233·9	7·28	.....	·678	Daylight 10.15 A.M.
56	Σ 1196	ζ Cancri	8 5 20	+18 1	86·8	0·66	.....	·703	
57	Σ 1744	ζ Ursæ Maj...	13 19 5	+55 33	147·3	14·87	.....	·681	Daylight 9.30 A.M.
58	Σ 1877	ε Bootis	14 39 45	+27 35	328·1	2·90	.....	·717	Daylight 3 P.M.
59	Σ 1998	ξ Scorpii	15 57 46	−11 3	189·6	1·37	.....	·706	
					188·7	0·94	.....	·709	
60	♅ III. 7	β Scorpii	15 58 28	−19 29	26·7	12·72	.....	·736	At 5.30 P.M.

48. *θ¹ Orionis.* The first measure was made fifteen minutes before sunrise in broad daylight. Both the 5th and 6th stars were readily seen for some time after this, and until I stepped outside to see the sun rise. Seven minutes later the sun appeared from behind the Sierra Nevada, 130 miles distant.

49. *β* 89. A very difficult pair near ε Orionis. Undoubtedly a binary system.

De	P=344°·2	D=0″·55	1875·7
O. S.	354°·0	0″·93	1878·0
β	361°·7	0″·71	1879·1
β	364°·0	....	1879·7

No.	Double Star.	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
			h. m. s.	° ′	°	″			
61	β 120	ν Scorpii.....	16 5 1	−19 9	1·1	.....	.....	·641	A B
					336·0	.....	.....	·638	A C
					337·6	.....	.....	·641	
62	.....	Antares	16 22 2	−26 10	272·8	.....	.....	·638	
					275·7	.....	.....	·641	
63	Σ 2055	λ Ophiuchi ..	16 24 52	+ 2 15	35·2	1·74	.....	·706	
					33·0	1·28	.....	·709	
					33·5	2·18	.....	·736	Before sunset
64	Σ 2084	ζ Herculis ...	16 36 47	+31 49	120·2	1·32	.....	·641	
					125·4	0·91	.....	·701	
					126·1	.....	.....	·703	
					127·2	1·27	.....	·709	
65	0Σ 315	21 Ophiuchi..	16 45 19	+ 1 25	159·9	0·936	6· .. 7·5	·709	Binary
66	0Σ 328	68 Herculis ..	17 12 54	+33 14	57·5	.....	6· ..12·	·703	
					59·6	3·51	6· ..12·	·709	
67	A. C. 7	μ^2 Herculis...	17 41 47	+27 48	239·0	.....	.....	·703	B C
68	Σ 2262	τ Ophiuchi...	17 56 33	− 8 11	251·1	1·62	.....	·706	
					253·1	1·43	.....	·709	
69	Σ 2272	70 Ophiuchi..	17 59 23	+ 2 33	.....	2·35	.....	·706	
					70·5	1·97	.....	·709	
70	Σ 9, app II	α Lyræ.....	18 32 52	+38 40	156·1	48·00	.....	·703	
71	Σ 37, app I	ε Lyræ	18 40 22	+39 33	172·5	207·17	.....	·681	By Daylight
72	Winlock	ζ Sagittarii....	18 55 0	−30 03	54·8	0·3±	.....	·711	
73	H 5084	γ Coronæ Aust.	18 58 18	−37 14	240·0	0·87	5·5.. 5·5	·695	Rapid binary
74	Σ 43, app I	β Cygni	19 25 53	+27 42	55·1	34·32	.....	·736	At 5.30 P.M.
75	A.G.C. 11	ζ Sagittæ	19 43 39	+18 51	.....	.....	.....	·641	Plainly elongated
					148·8	.....	.....	·711	

67. μ^2 *Herculis.* The duplicity of Struve's companion was discovered by Mr. Alvan Clark in 1856. I do not think it has ever been seen, much less measured, with so small an aperture.

75. ζ *Sagittæ.* The duplicity of the large star was discovered in 1875 by Mr. Alvan G. Clark with a 12-inch telescope. It is excessively close and difficult. The only prior measures are mine with the 18½-inch: β P=157°·6 D=0″·29. 1878·1

No.	Double Star.	Star Catalogue.	R. A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	1879+	Notes.
			h. m. s.	° ′	°	″			
76	H 5178	.....	20 6 0	−34 35	9·8	1·74	7·0.. 9·0	·681	
					7·2	.....	.....	·684	
					11·3	1·41	7·8.. 9·0	·695	
77	H 607	α^1 Capricorni .	20 11 0	−12 53	220·8	44·80	.....	·675	
					218·6	44·30	.....	·678	
78	H 608	α^2 Capricorni .	20 11 24	−12 55	154·0	6·33	.....	·638	A B
					145·5	6·28	.....	·675	
					.....	156·68	.....	·638	A D
					157·5	156·10	.....	·675	
					156·0	156·16	.....	·678	
79	β 63	1 Delphini...	20 24 33	+10 30	344·9	0·67	.....	·706	
80	OΣ(app)210	.....	20 44 1	+ 5 6	121·9	81·98	6·5.. 9·0	·681	
81	Σ 2729	4 Aquarii....	20 45 4	− 6 4	161·9	0·72	.....	·706	Distance too large
					164·6	0·46	.....	·709	
					175·8	.....	.....	·711	
82	β 251	.....	21 4 53	−31 5	234·4	2·09	8·0.. 9·5	·695	
83	Σ 2777	δ Equulei....	21 8 38	+ 9 31	23·0	.....	.....	·703	
					22·4	38·74	.....	·706	
					22·8	38·77	.....	·709	
84	Σ 2822	μ Cygni	21 38 46	+28 12	116·5	3·50	.....	·736	
85	β 276	η Piscis Aust.	21 53 56	−29.02	113·3	1·17	5· .. 6·	·681	Distance larger
86	β 172	51 Aquarii...	22 17 52	− 5 27	16·1	0·73	6· .. 6·	·706	
87	H 5367	γ Piscis Aust.	22 45 51	−33 31	271·6	3·60	6· .. 8·5	·695	
					271·6	3·33	.. 9·0	·701	
88	Dunlop 251	θ Phœnicis...	23 33 1	−47 18	278·7	3·56	6·5.. 8·	·692	
					263·7	3·22	.....	·701	
89	A.G.C.14	78 Pegasi....	23 37 57	+28 42	184·8	0·94	6· ..10·	.709	
					188·7	1·39	6· .. 8·5	·736	
90	.....	85 Pegasi....	23 55 52	+26 27	28·3	15·76	.....	·709	A C
					29.2	14·33	6· ..10·	·736	

76. H 5178. Herschel gives: 9°·6 (1834·7).

89. 78 *Pegasi*. A difficult pair discovered by Mr. Alvan G. Clark in 1875 with a 12-inch.

Astronomische Nachrichten.

Expedition auf der Königlichen Sternwarte bei Kiel.

Herausgeber: Prof. Dr. C. A. F. Peters.

Bd. 86. **No. 2062.** **22.**

Sixth Catalogue of 90 new double stars discovered with a 6-inch refractor.

By *S. W. Burnham.*

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The five lists of new double stars preceding this have been published in the „Monthly Notices“ of the Royal Astronomical Society for March, May and December 1873, and June and November 1874. The pairs included in the following list have all been discovered with the 6-inch refractor of Clark & Sons, previously described, since the close of the observations given in the Fifth Catalogue, or between October 24, 1874, and August 22, 1875 on the dates given in the eighth column. Eleven of the close pairs are stars bright enough to be within the reach of the unassisted vision. The principal components of seven of the double stars of Herschel, Struve and South have been again divided, five of them not much exceeding 0″5 in distance:

H 3761
H 3780
S 537
Σ 1026
Σ 1097
H 1828
H 5532

In a few instances, when the interest of the object seemed to warrant, companion stars have been noted beyond the limiting distance of 10″ heretofore adopted. The magnitudes are given in accordance with Struve's scale, and the angles and distances usually estimated. The places of the new pairs have from time to time been communicated to the distinguished double star observer, Baron Dembowski, and I am fortunate in being able to greatly enhance the value of my own observations by attaching the measures made by him and kindly forwarded to me.

The reference numbers in the first column are continued from the other catalogues.

Nr.	Designation	RA. 1880	Del. 1880	Pos.	Dist.	Mags.	Discovered	Notes.
301	L 1350	$0^h43^m21^s$	$-22°\ 3'$	300°	5″	9...10	Oct. 19	Faint pair in Cetus.
302	P. O. 245	0 51 56	+20 45	93.8	0.71	7.0 ..8.0	Dec. 23	A fine close pair near ψ' Piscium, and just visible to the naked eye. Heis appears to have mistaken a fainter star a short distance preceding for this. All the star Catalogues give this as the brightest. The measures of this pair are by Dembowski (1875.08).
303	Piscium 201	1 3 9	+23 9	285.9	0.59	7.5...8.0	Nov. 1	This elegant and rather difficult pair is also a naked eye star (Heis 6.7 mag.). Measures by Dembowski (1875.08). He notes the stars as both white.
304	L 4613	2 24 5	+36 56	205.4	21.08	7.0...11.0	Dec. 30	Wide and unequal pair; Dembowski's measures (1875.09).
305	Persei 58	2 30 52	+37 13	240.	20	6.5...11.0	Dec. 30	Similar to the last, with a more distant companion north.

Designation	RA. 1880	Dcl. 1880	Pos.	Dist.	Mags.	Discovered	Notes
Arietis 107	$2^h36^m52^s$	$+25^\circ$ 8′	40°	4.	6.5...11.0	Feb. 7	This star is B. A. C. 834. Companion very minute. Heis gives the primary 6.7 magnitude.
L 5133	2 40 29	+29 11	300.	10.	8.0...10.0	Jan. 28	About 25′ north of 39 Arietis.
Weisse III 564	3 32 5	— 8 3	320.	1.2	8.5...9.5	Oct. 24	This pretty and rather difficult pair is the north star of a wide pair (70″±)
L 7655	4 1 21	+19 25	278.8	5.60	8.0...11.5	Dec. 26	Preceding ω Tauri 48^s, and 7′25″ north measured by Dembowski on two nights (1875.07).
W. IV. 258	4 14 21	+39 39	180	10.	8.0...11.0	Nov. 1	A very delicate object.
Eridani 315	4 21 54	—24 21	160.	1.	6.5...7.0	Oct. 24	This fine close pair is Lacaille 1451.
L 9065	4 42 36	—21 1	330.	2.	8.0...9.5	Jan. 7	A pretty pair in Eridanus.
Camelop. 54	4 49 7	+68 59	250.	10.	6.5...11.5	Dec. 26	Companion excessively faint. There is a more distant one south following.
Leporis 3 A and B	4 53 39	—16 34	140.	0.5	6.0...6.0	Feb. 9	Are exceedingly difficult pair, the distance of which may be overestimated. Heis and Argelander place this in Eridanus.
AB and C			30.	50.	9.0		
O. Arg. N. 5402	4 53 54	+49 22	240.	3.	8.5...9.0	Oct. 16	Unimportant pair of small stars.
L 9181	4 56 51	— 5 29	180.	1.2	7.8...7.8	Feb. 9	A beautiful pair in a low-power field with ω Eridani, about 10′ north.
L 9852	5 8 53	—23 8	15.	5.	7.0...9.0	Dec. 14	In Lepus.
L 9873	5 10 11	— 3 37	226.7	0.63	8.5...9.0	Dec. 17	Very close and difficult pair in Orion; measured by Dembowski (1875.11).
O. Arg. S. 3957	5 21 15	—20 49	225.	4.	7.5...10.5	Dec. 14	A pretty pair 1^m 50^s preceding β Leporis.
β Leporis	5 23 6	—20 51	267.1	2.89	3.5...11.0	Dec. 17	Sir John Herschel entered this in the list of double stars in Cape Observations (II 3761) with a 13^m companion 70″ distant. In looking for this companion, which Smythe does not mention in the Cycle of Celestial Objects in measuring a still more distant star in the field, the close star was discovered. This elegant pair has been measured by Dembowski (1875.11). In distance, angle, and relative brightness of the two stars, it resembles Antares, but is a more difficult pair in this latitude.

Nr.	Designation	RA. 1880	Dcl. 1880	Pos.	Dist.	Mags.	Discovered	Notes
321	Leporis 45	5h33m59s	—17°55′					H 3780 of Cape Observations is entered without distances or angles, with this description only: „quintuple, 6th and 7th Classes. Magnitudes, (7), (7), (8), (8), (8)“ Looking this up to supply some further details, the group was found to consist really of six stars, two of them being quite small. The star E is probably the one not noticed by Herschel. The relative places of these stars are given with rough measurements. The star C was at once perceived to have a near companion, and the principal star, A, suspected to be a very close pair, but was not satisfactorily verified until some nights later. The latter is very difficult with my aperture, and the other by no means easily seen under ordinary atmospheric conditions. Taken together the group is a very interesting one. The large stars, A, B, C, and D are respectively 10726, 10727, 10728 and 10725 of Lalande. The system is just visible to the naked eye, and shown on Heis' star atlas as 6.7 mag. It is 6m35s exactly following α Leporis.
	A and B			7.	80.	7...8		
	A and C			136.	90.	9		
	A and D			300.	125.	8		
	A and E			46.	50.	10		
	A and F			105.	90.	9.5		
	A and a			135.	0.5	8	Dec. 14	
	C and c			360.	1.5	10	Dec. 14	
322	O. Arg. S. 4178	5 34 40	—25 13	100.	1.8	8...9	Febr. 20	Another pair in Lepus.
323	L 11915	6 8 44	— 1 41	90.	1.7	8...9	Febr. 27	Pretty pair in Monoceros.
324	Lacaille 2462	6 44 45	—23 56	190.	2.	7...9	Febr. 7	The wide pair, A and C, is the double star, S 537. but South failed to notice the close companion. His measures of the distant star are given. It is a very easy object, and rather strangely missed heretofore. The wide pair (27″8) in the field 4′ south is S 538.
	A and B							
	A and C			281.9	30.30	11		
325	O. Arg. S. 5814	6 46 59	—26 26	20.	1.6	7.8...8.5	Febr. 8	The south following star of a wide pair.
326	L 13404	6 49 57	+ 2 28	60.	1.2	7.8...8.5	Jan. 22	Pretty pair in Orion.
327	L 13492	6 52 28	— 2 52	90.	1.	8.0...8.5	Jan. 22	A fine triple star.
	A and B							
	A and C			100.	10.	10.0		

Nr.	Designation	RA. 1880	Dcl. 1880	Pos.	Dist.	Mags.	Discovered	Notes.
328	Σ 1026 rej.	7h 1m 3s	—11° 7′	135°	0″7	6.0...8.0	Feb. 8	A and C constitute the double star Σ 1026, which by reason of the distance and faintness of the companion was rejected in meas. micr. The large star is a very close and difficult pair, and perhaps closer than estimated. Dembowski measured the angle on two nights (1875.25) giving 130°8 and 127°3, and notes on the first occasion, „if a separation, I have but the suspicion; very difficult". The principal star, which is Can. Maj. 139, is shown on Heis' maps as 6.7 mag.
	A and B							
	A and C			350.	20.	9.5		
329	Can. Maj. 146	7 4 8	—16 2	95.	15.	6.0...10.5	Feb. 10	Bright star with very faint companion.
330	Anon.	7 13 27	— 0 41	220.	1.2	8.5...9.0	Feb. 9	Pretty pair of small stars.
331	Anon.	7 15 36	—24 9	120.	2.	8.0...9.0	Feb. 7	About 10′ north-following 29 Canis Majoris. Not in any star catalogue I have been able to refer to.
332	Σ 1097	7 22 14	—11 19	166.4	0.80	6.5...8.5	Jan. 28	Struve only gives the companion C. The fourth star, D, was noted by Sir John Herschel in one of his Catalogues. (Mem. R. A. S. Vol. III). The pair was examined to see if the two distant stars were identical, and the large star at once detected to be a close pair, the Elongation being nearly in the direction of Herschel's companion. Subsequently Dembowski measured it on two nights (1875.25) the results agreeing almost exactly, the mean being here given. Struve's measures of his companion are given for that star and my own estimates of the fourth companion, which, so far as I am aware, has never been measured. The star C has a minute attendant at a distance of about 12″ in the direction of 305°. Dembowski finds that he suspected the duplicity of the principal star several years ago, but neglected to follow it up at that time. This is P VII. 116 (=B. A. C. 2470) and given 6 magnitude by Argelander and Heis.
	A and B							
	A and C			312.1	20.20	8.7		
	A and D			165.+	30.±	9.8		
333	Argus 269	7 57 23	—22 1	40.	2.	7.5...9.0	Feb. 20	Fine double star with a distant companion.
	A and B							
	A and C			60.	30.	8.5		This is L 15760 = O. Arg. S. 7866.
334	L 15933	8 2 3	—21 42	350.	2.	8.0...9.0	Feb. 20	Very easy pair in Argo.
335	L 17341	8 41 58	+ 3 2	270.	3.	7.5...11.0	April 11	The preceding of these stars in the field.

Nr.	Designation	RA. 1880	Dcl. 1880	Pos.	Dist.	Mags.	Discovered	Notes
336	L 18173	$9^h\ 6^m10^s$	$-16°19'$	240°	1″2	8.0...9.0	Mch. 27	The wide and unequal pair, 1^m36^s following and 3′ north, is H 4182.
337	L 18502	9 16 54	−17 23	320.	10.	7.0...9.5	Mch. 27	The south following of two stars.
338	L 18518	9 17 16	−14 59	270.	7.	8.5...9.5	Mch. 27	Faint pair.
339	L 18737	9 25 16	−15 13	220.	1.1	8.0...9.5	Mch. 27	Five pair of small stars.
340	Lamont 624	11 23 49	+ 3 51	7.6	3.96	8.0...10.0	May 2	Rather difficult; measured by Dembowski May 26th.
341	Hydrae 348	12 57 19	− 19 56	140.	1.	6.0...6.0	May 29	A fine close pair, and not difficult. In some of the Catalogues this is rated as high as 5th magnitude.
342	O. Arg. S. 12741	13 8 49	−18 17	35.	4.	7.8...9.0	May 29	A considerable distance south following 54 Hydrae.
343	Centauri 219	13 45 8	−31 1	120.	1.2	6.0...8.5	April 20	This beautiful pair is readily seen, notwithstanding its low altitude. It is near the well known pair ι Centauri, and is Nr. 4624 of the B. A. C.
344	O. Arg. S. 13285	13 52 23	−24 58	130.	3.	9.0...9.0	May 14	The wide pair 3^m9^s preceding is H. N. 59.
345	Lac. 6051	14 34 39	−29 11	150.	1.	7.0...7.0	May 30	Close and rather difficult pair.
346	Librae 23	14 41 49	−16 50	250.	1.	7.0...8.0	May 16	Distance may be slightly underrated. This is L_4 26940.
347	Centauri 330	14 47 18	−32 49	340.	10	6.0...10.0	May 12	Large star appeared reddish. This is B. A. C. 4912.
348	2 Serpentis	14 55 40	+ 0 20	130.	0.5	6.0...6.0	May 16	A splendid close pair, and not very difficult ander the best conditions. A mean of four measures of the angle by Dembowski July 7th gives, P = 117°2. One of Sir William Herschel's wide pairs, H VI. 51, is erroneously called a 2 Serpentis. It is 1 Serpentis, a star 4^m 17^s preceding and 1′17″ south. It has a 10 mag. companion of Class VI in the direction of about 220°.
349	L 27579	15 2 52	+ 2 9	50.	3.	7.5...11.8	June 7	Excessively unequal and difficult.
350	B. A. C. 5020	15 8 29	−27 9	170.	1.3	6.5...8.0	May 23	Very fine southern pair.
351	O. Arg. S. 14417	15 10 20	−15 8	300.	5.	8.0...11.6	May 23	Companion very faint, but bears magnifying well.
352	O. Arg. S. 14427	15 10 43	−26 33	170.	10.	8.5...9.5	May 29	In the vicinity of Nr. 350.
353	Redhill 2307	15 13 55	+85 57	300.	2.	9.0...9.0	April 21	One of the components of a wide pair.
354	O. Arg. S. 14797	15 36 0	−25 2	280.	6.	7.0...9.0	May 12	Very easy double.
355	L 29506	16 4 14	+45 42	100.	0.4	7.0...7.0	May 18	Excessively difficult pair 56^s preceding Σ 2015. Elongation slight on the best occasions. Probably the the most severe test for a small aperture of the close pairs in this list.
356	O. Arg. N. 16336	16 29 51	+69 12	270.	5.	8.5...10.0	May 6	A little following, and 10′ north of 15 Draconis.

Nr.	Designation	RA. 1880	Dcl. 1880	Pos.	Dist.	Mags.	Discovered	Notes
357	L 31094	$16^h59^m52^s$	$+10^\circ43'$	280°	1″2	7.5...10.0	July 29	Difficult.
358	W. XVII. 1374	17 43 10	+34 32	205.	5.	8.5...10.0	July 18	About 20′ north of O Σ 336.
359	W. XVIII. 1849	19 0 7	+23 13	9.0	5.	8.0...9.5	July 29	Near Σ 2445.
360	Anon.	19 14 18	+35 0	75.	5.	8.0...9.5	July 12	A distant companion in the direction of 345°.
361	W. XIX. 1429	19 45 7	+22 22	350.1	3.24	9.0...9.7	Nov. 6	About 10′ from 12 Vulpeculae, north preceding. The measures a mean of two nights by Dembowski.
362	Radcliffe 4737	20 15 54	+44 59	120.	0.4	7.0...7.0	July 24	A very close and difficult pair about 2^m following, and 17′ south of Σ 2667.
363	Vulpeculae 93	20 24 28	+20 12	60.	20.	7.0...11.0	Nov. 7	The companion exceedingly faint.
364	L 40166	20 41 52	+24 58	218.1	1.02	8.7...9.2	Nov. 8	Near 30 Vulpeculae. Dembowski's measures (1874.91). In a later observation he gives the angle 40°6, and says, „the north star certainly the smiallest“. At the time of finding it, I estimated the angle angle 240°.
365	O.A.N. 21118	20 43 36	+51 21	300.	5.	8.0...11.5	July 11	Only seen by careful attention. It is 1^m29^s following, and 6′41″ north of Σ 2732.
366	O.A.N. 21157 A and B	20 44 49	+50 3	140.	1.5	8.5...9.0	Aug. 7	Following O Σ 412 2^m48^s, and about 11′ south.
	A and C			105.	45.	9.5		
367	L 40478	20 49 53	+27 38	120.	0.4	8.0...8.0	Nov. 12	Excessively difficult pair in the field with 32 Vulpeculae.
368	Aquarii 45	21 1 1	— 9 43	100.	0.5	8.0...8.0	Aug. 8	This star was thought to be a close pair in 1873, but I was unable to decide positively. Examining it again on this occasion, the duplicity was very apparent, the stars being nearly separated with 400. This is L 40892.
369	Radcliffe 5237	21 22 31	+52 14	60.	10.	7.0...11.0	Aug. 17	A difficult pair 3^m23^s preceding Σ 2803.
370	O.A.N. 22429	21 28 14	+52 13	340.	4.	8.5...9.0	Aug. 17	Easy and uninteresting pair.
371	O.A.N. 22566	21 32 58	+58 10	40.	5.	8.0...10.0	Aug. 16	
372	Arg. (50°) 3403	21 35 49	+51 1	360.	1.4	8.0...10.5	Aug. 17	Beautiful little pair 2^m1^s preceding π' Cygni, and 22′ north.
373	Anon.	21 37 1	+48 47	170.	2.5	9.0...10.0	Aug. 6	The south star of a wide pair.
374	O.A.N. 22750	21 38 59	+50 27	160.	1.2	8.0...10.5	Aug. 17	Almost an exact duplicate of Nr. 372. It is 1^m10^s following π' Cygni, and 11′ south. They are both rather difficult.
375	O.A.N. 23503	22 4 29	+50 11	330.	1.	8.0...9.0	Aug. 17	The 6 mag. star 2^m following with a distant companion is H 1741.
376	Radcliffe 5607	22 8 1	+59 30	150.	3.	7.5...11.7	Aug. 12	Very difficult pair 22′ south of Σ 2880. Best seen with high power.
377	O.A.N. 23765 A and B	22 11 22	+54 4	65.	60.	8.0...10.0	Aug. 17	Minute double companion.
	B and C			30.	3.	10.5		
378	O.A.N. 23808	22 12 50	+60 16	90.	4.	8.5...9.0	Aug. 12	

Nr.	Designation	RA. 1880	Dcl. 1880	Pos.	Dist.	Mags.	Discovered	Notes
379	Radcliffe 5658	22h16m 0s	+53°13′	330°	1″	8.5...9.0	Aug. 17	A fine close pair.
380	Radcliffe 5693 A and B	22 22 2	+49 6	325.	20.	8.0...10.8	Aug. 5	A and C make Nr. 234 of the list of wide doubles in the Poulkowa Catalogue.
	A and C			135.	35.	8.3		
381	W. XXII. 580	22 27 22	+32 47	210.	1.2	8.0...10.5	Aug. 22	A delicate pair in Pegasus.
382	H 1828 A and B	22 48 18	−44 7	225.	1.	6.0...8.0	Oct. 26	The distant companion discovered by Herschel. With the newly found close star it is a very beautiful and interesting triple. The large star is B. A. C. 7983 and is readily visible to the naked eye.
	A and C			350.	20.	9.8		
383	L 44855	22 49 57	+ 8 49	240.	10.	8.0...11.0	Nov. 10	Very faint attendant.
384	Aquarii 265	22 56 14	−19 5	90.	1.	7.0...9.0	Nov. 1	A close, and rather unequal pair; difficult under ordinary conditions.
385	H 5532 A and B	23 4 31	+31 50	130.	0.4	7.8...7.8	Oct. 24	The wide pair noted by Herschel; distance not given, but described as belonging to Class VI. I find the larger star a remarkably close and difficult double. It required the very best conditions to make the duplicity beyond doubt. The principal star is Weisse XXIII. 40. Herschel gives the magnitudes of A and C as 7 and 9 respectively.
	A and C			80.	60.	8.5		
386	B. A. C. 8173	23 21 12	+70 1	320.	20.	6.0...11.0	Aug. 13	A distant minute companion.
387	L 46162	23 28 8	−10 22	80.	5.	8.0...9.0	Nov. 12	An unimportant pair.
388	W XXIII 590	23 28 52	+37 30	340.	25.	6.5...10.4	Dec. 29	Given by Heis 6.7 magnitude.
389	L 46423	23 35 18	+31 54	45.	15.	7.5...10.8	Dec. 30	Similar to the last, but both stars smaller.
390	L 46617	23 41 33	+48 38	240.	10.	8.0...11.0	Aug. 6	Companion very faint.

Note. Since the completion of the foregoing list I have found the sixth magnitude star, B. A. C. 282, near γ Cassiopeiae, to be a remarkably difficult double star. The companion is very minute, and within 1″ of the bright star. It will require careful attention with any aperture. It place is: RA. 0h56m13s; Decl. +60°26′.

Chicago, August 24, 1875.

Neue Elemente des Planeten (100) Hecate.

Aus den Oppositionen in den Jahren 1868, 1869, 1871, 1872 und 1874 leitete ich folgendes Elementensystem ab:

Epoche und Osculation 1875, December 21.0, mittleres Aequinoctium 1880.0.

$L = 78°19′37″37$
$M = 130\ 39\ 19.75$
$\pi = 307°40′17″62$
$\Omega = 128\ 12\ 1.67$
$i = 6\ 23\ 11.64$
$\varphi = 9\ 26\ 39.45$
$\mu = 652″48673$
$\log a = 0.4902899$

Utrecht, im April 1875. Dr. *J. E. Stark.*

Bedeckung von α Virginis durch den Mond, beobachtet in Pulkowa, 1875, September 3.

Beob. Eintritt $0^h38^m37^s8$ mittlere Pulkowaer Zeit, ziemlich gut, Stern unruhig und schwach.
Beob. Austritt 1 40 52.9 „ „ „ gut.
Instrument: sechszölliger Refractor Repsold Nr. 5; Beobachter: *W. Fabritius.*

Observations faites à l'observatoire de Marseille.

Planète (149) Découverte, à Toulouse, pour M. Perrotin.

1875	T. M. de Mars.	AR.	L. f. p.	P.	L. f. p.	*	Obs.
Octobre 1	$9^h\ 7^m23^s$	$23^h8^m\ 1^s63$	−1.1748	96° 8′ 56″8	−0.8277	a	Borrelly
2	9 35 49	23 7 17.82	−2.9485	96 13 57.3	−0.8298	a	„
3	8 57 47	23 6 37.08	−1.1749	96 18 36.8	−0.8288	a	„
5	8 51 55	23 5 17.81	−1.1589	96 27 42.0	−0.8298	b	„
6	9 4 31	23 4 40.75	−1.1513	96 32 1.5	−0.8313	b	„
8	11 28 23	23 3 29.03	+1.2417	96 40 18.8	−0.8299	c	„

Note: Heure de l'Observ.

Planète (150) Découverte par M. Watson.

Octobre 20	10 14 16	0 59 42.98	−2.9764	83 9 38.0	−0.7246	c	„

Positions moyennes des étoiles de comparaison pour 1875.0.

*	Cr.		AR.	P.	Autorité.
a	8.9	142 Weisse (a. c.) H. XXIII	$23^h\ 9^m13^s25$	96° 22′ 40″7	Cat. W.
b	7	8073 B. A. C.	23 4 10.26	96 38 17.05	Cat. B. A. C.
c	8.9	968 Weisse (a. c.) H. 0	0 56 19.87	83 10 18.7	Cat. W.

Ces observations ont été faites ici par M. Borrelly.

La planète (150) indiqué comme étant de 14. grandeur par la dèpèche américaine est en réalité de 11. grandeur. *Stephan.*

Anzeige.

Es ist schon in früheren Bänden bemerkt worden, dass ohne ausdrückliche Bestellung und Vorausbezahlung keine Nummer eines neuen Bandes versandt wird. Die Herren Abonnenten, welche diese Blätter fortzusetzen wünschen, werden also ersucht, um Unterbrechungen zu vermeiden, baldmöglichst ihre Bestellungen einzusenden.

Man pränumerirt bei der Expedition dieses Blattes (Kiel, Königliche Sternwarte) mit 9 Mark 60 Pfennigen deutscher Reichsmünze, und von diesem Preise wird auch den Buchhandlungen und Postämtern kein Rabatt gegeben, die also nothwendig ihren Abnehmern höhere Preise berechnen müssen. — Ueberhaupt sind alle in dieser Anzeige berechneten Preise Nettopreise.

Für die mit der Post versandten Exemplare findet eine kleine Erhöhung statt, so dass der Preis für den Band, incl. Porto, sich stellt: Für Deutschland und Oesterreich auf 12 Mark deutscher Reichsmünze, für England auf 15 sh., für Frankreich und Italien auf $17^1/_4$ Francs, für Nordamerika auf $3^2/_3$ Dollars, für Holland auf $1^1/_2$ holländische Ducaten.

Einzelne Nummern werden nur zur Completirung, wenn sie vorräthig sind, à 50 Pfennigen abgelassen.

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Zu Nr. 2062. *S. W. Burnham.* Sixth Catalogue of 90 new double stars discovered with a 6-inch refractor. 337. — *J. E. Stark.* Neue Elemente des Planeten (100) Hecate. 349. — *W. Fabritius.* Bedeckung von α Virginis durch den Mond, beobachtet in Pulkowa, 1875, September 5. 351. — *Stephan.* Observations faites à l'observatoire de Marseille. 351. — Anzeige. 351.

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Measures of Barnard's new Merope nebula

with the 36 inch Equatorial.

By *S. W. Burnham.*

In November, 1890, Mr. *Barnard* discovered a new nebula in the Pleiades (A. N. 3018) which had escaped detection by all previous observers from the fact that it is so close to the bright star, Merope, that it is buried in the brilliant light of that star and completely hidden in ordinary observations. I have lately made a set of measures of this singular object from Merope with the 36 inch Equatorial. The nebula is readily seen with that instrument when one is aware of its existence, and it can probably be seen now with a somewhat smaller aperture; at the same time, its discovery with any instrument is little less than remarkable, from the difficulty of seeing it at all except when the bright star is placed outside of the field, and of course there is only one position which is favorable for this purpose. The distance between the two is so small, that the nebula even then is in the extreme margin of the field, and easily overlooked without careful attention.

Merope and new nebula.

1891.689	167°.1	37".72
692	167.0	35.79
728	164.2	36.00
731	167.0	34.89

Mr. *Barnard*, with the same instrument, measured the difference of Right Ascension and Declination between the two objects, and obtained:

Diff. R.A. = 9".04
Diff. Decl. = 35.72

The position angle and distance deduced from these observations, and the mean result of the foregoing direct measures are as follows:

1890.92	165°.8	36".85	*B* 2n
1891.71	166.3	36.10	*β* 4n

These independent results are certainly remarkably accordant, when the character of the new nebula is considered. If it were a star, or had a well-defined central point, there would be no difficulty; but in this case a faint disc of light, at least ten or twelve seconds in diameter, has to be bisected by the wire in the extreme margin of the field, and there is necessarily under the circumstances a good deal of uncertainty in doing this as compared with the bisection of a star, however faint, or difficult to see.

A rough setting of the wires to include the more readily visible diameter of the nebula in the direction of Merope gave 12".8; but this must not be taken as a measure, even approximately, of its extreme dimensions. In the paper referred to Mr. *Barnard* estimated it as about 30" in diameter, and I have no reason for changing this value. The drawing given in A. N. 3018 is a faithful representation of the nebula, and its position with reference to Merope.

This is not only far more interesting than any of the nebulae heretofore discovered in the Pleiades by visual and photographic method, but, judging from its situation and appearance, is one of the most singular objects in the heavens. With respect to its nearness to a bright naked-eye star it is unique. There may be other examples, but certainly no other has ever been discovered, and this close association of a faint nebula and one of the prominent stars of the Pleiades is an interesting fact whether such association is accidental or otherwise. No star bright enough to be visible to the naked-eye is known to have a small, definite nebula even within several times the distance of this nebula from Merope. Of course there are many examples of large stars involved in widely diffused and extended nebulous masses, of which *Tempel*'s nebula about the star in question is an illustration, but these nebulous objects appear to be of an entirely different character from the circular, condensed forms so often found among the small detached nebulae. It may be that a careful examination of the bright stars by cutting off their light from the surrounding field would reveal other examples of companion nebulae.

These measures were made with a power of about 500 in order to give the best separation, and get rid of the objectionable light of the star as far as possible. Of course with such a power nothing would be seen of the nebulous background discovered by *Tempel*. These measures may be of more interest in the future when it will be possible by careful re-measurement to ascertain whether the new nebula is drifting in space with Merope and the other stars of this famous group.

Mt. Hamilton, 1891 Oct. 10.

S. W. Burnham.

Measures of the binary star Σ 2367

with the 36 inch Equatorial.

The close pair of this triple system has been a difficult object since the first observations by *Struve*. The maximum distance is probably not much greater than 0".4, and for the last twenty years it has been gradually diminishing. It is now a pretty good test for the 36 inch telescope of this observatory. I have the following measures this year:

1891.326	107°.1	0".07 ±
389	109.3	0.09
578	104.6	0.09
1891.43	107.0	0.09

The distance in the first observation was estimated. There is no doubt about the proper quadrant being given for the smaller component. The stars are sufficiently unequal to make this certain, even with the present small distance.

As but few measures have been made of the close pair, it may be convenient hereafter to give these observations in chronological order. The following is a complet list of the measures, omitting only negative results where the pair was noted as single, etc.

1833.88	68°.3	0".4	Σ	3n
1843.77	70.4	0.3	*Ma*	1n
1846.95	77.8	0.53	*OΣ*	3n
1862.73	66.3	0.55	*Ma*	3n
1874.72	67.8	0.37	*N*	2n
1875.65	242.3	0.32	*Sp*	4n
1883.62	250.4	0.30	*Sp*	3n
1883.94	62.1	0.22	*En*	6n
1891.43	107.0	0.09	β	3n

It appears from these measures that the motion is very slow, and that until recently the change has been principally in distance. There seems to be no doubt of the smaller star having been on the following side during the entire time covered by the observations, and, therefore, the period must be a long one. It may be some years before it is measurable again, as the distance will probable still further diminish.

There is a third star about 14" distant, in the direction of 194°, but there has been no sensible change in its position since the measures of *Struve* in 1832.

Mt. Hamilton, 1891 Sept. 15.

S. W. Burnham.

The discovery of the duplicity of the principal star of Σ 3018.

In the course of making a series of measures of 72 Pegasi (β 720) with the 36 inch refractor, I happened to look at a star in the immediate vicinity, which proved to be Σ 3018, and saw that the larger component of this wide pair was a close double. It is easy enough with the large telescope, but still close enough to have escaped detection by those who have previously measured the wide pair, without any change in the distance.

With the 36 inch I have made the following measures of A and B:

1891.673	72°.1	0".24	7.5	7.5
692	75.6	0.26	7.3	7.3
709	74.2	0.23	7.5	7.5
1891.69	74.0	0.24	7.4	7.4

Lick Observatory, 1891 Oct. 10.

With the same instrument I have obtained the following measures for the wide stars (Σ 3018):

1891.673	203°.7	19".00	—	9.5
692	203.7	18.90	—	8.7
709	203.0	18.86	—	8.8

The following are all the measures of these stars:

1830.52	204°.0	18".92	7.2	9.5	Σ	3n
1843.74	203.4	19.41	—	—	*Ma*	1n
1864.45	204.0	18.98	7.2	9.0	Δ	3n
1870.07	203.8	18.83	7.9	9.8	*Du*	4n
1879.57	202.9	19.19	7.0	9.5	Cin_5	1n
1891.69	203.5	18.92	—	9.0	β	3n

Evidently there has been no change in the relative positions of these stars during the sixty years covered by the measures. It is equally certain that the new pair will ultimately prove to be a binary system.

S. W. Burnham.

(3)

DOUBLE-STAR OBSERVATIONS

MADE IN

1879 AND 1880

WITH THE

18½-IN. REFRACTOR OF THE DEARBORN OBSERVATORY

CHICAGO, U.S.

LELAND STANFORD JUNIOR UNIVERSITY JAN 30 1883 LIBRARY

I. CATALOGUE OF 151 NEW DOUBLE STARS WITH MEASURES

II. MICROMETRICAL MEASURES OF 770 DOUBLE STARS

P. 17555

BY

SHERBURNE WESLEY BURNHAM, M.A.

Reprinted from the MEMOIRS OF THE ROYAL ASTRONOMICAL SOCIETY, Vol. XLVII.

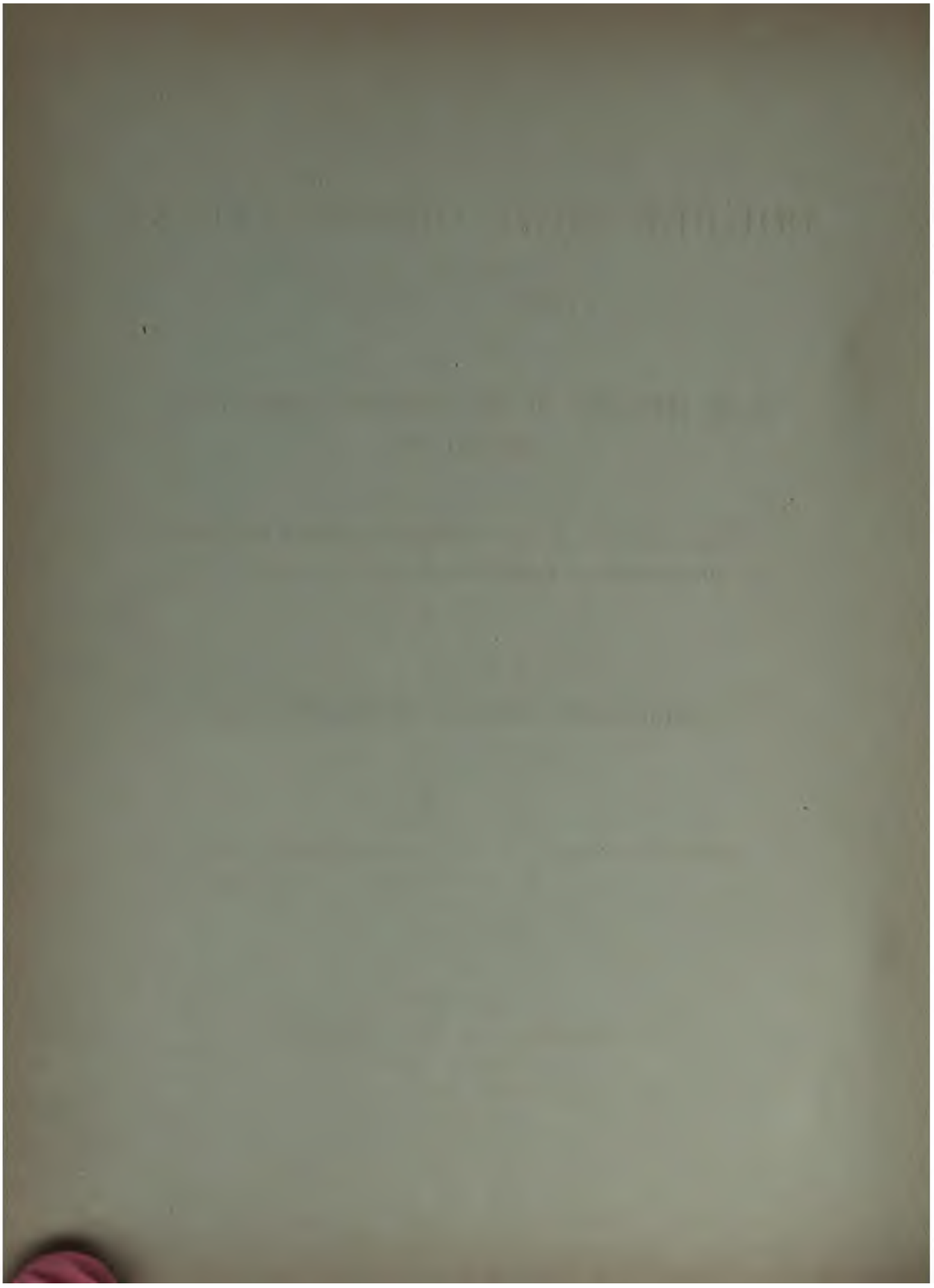
LONDON

PUBLISHED BY THE SOCIETY

AT THEIR APARTMENTS

BURLINGTON HOUSE

1883



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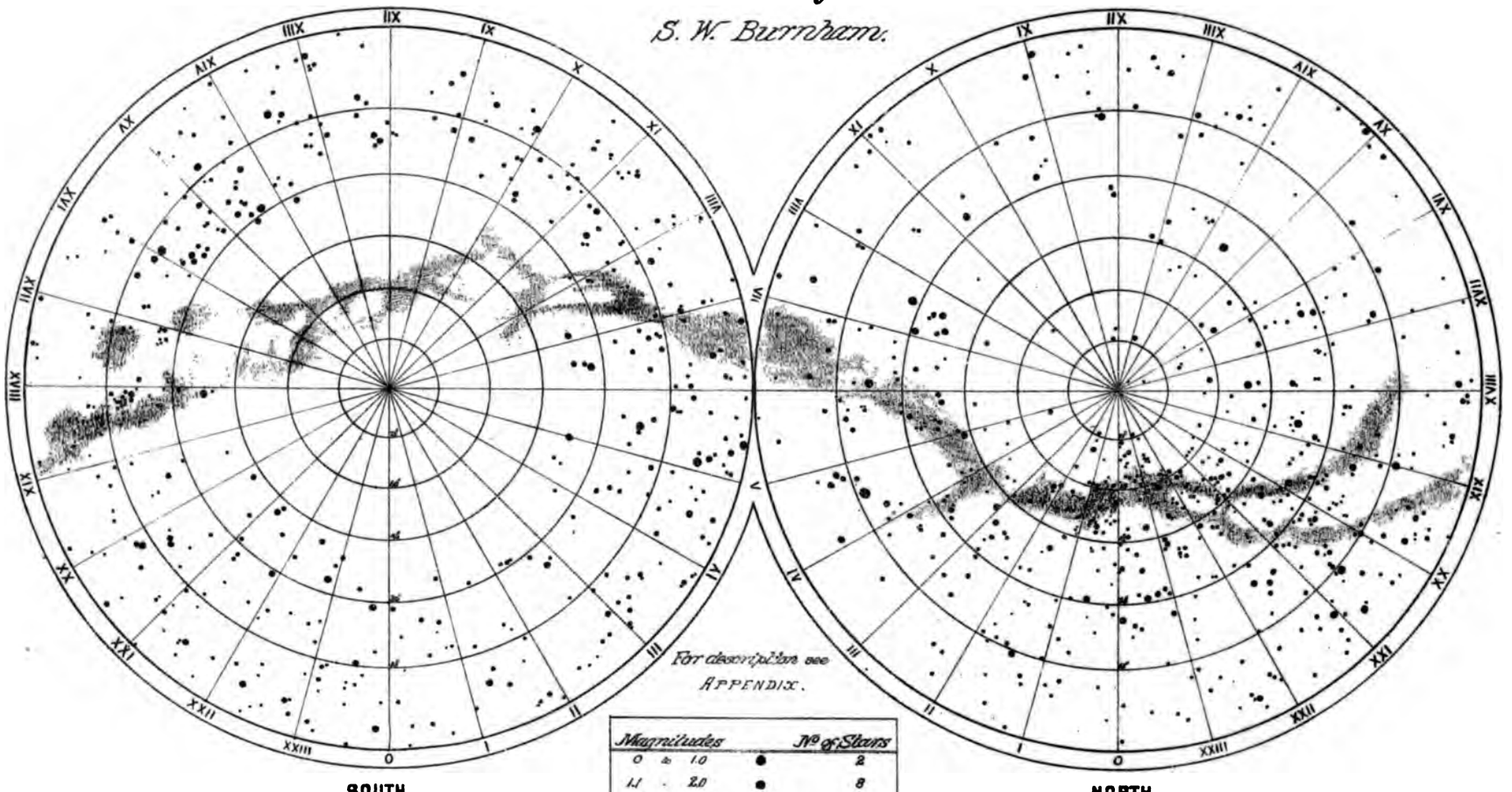
Map showing the distribution of the double stars

discovered by

S. W. Burnham.



For description see APPENDIX.

Magnitudes			№ of Stars
0 to	1.0	•	2
1.1 .	2.0	•	8
2.1 .	3.0	•	11
3.1 .	4.0	•	11
4.1 .	5.0	•	28
5.1 .	6.0	•	94
6.1 .	7.0	•	173
7.1 .	8.0	•	303
8.1 .	9.0	•	300
9.1 .	+	•	69
			1000

Double-Star Observations made in 1879 *and* 1880 *with the* 18½*-inch Refractor of the Dearborn Observatory, Chicago, U.S.*

I. *Catalogue of* 151 *New Double Stars with Measures.*
II. *Micrometrical Measures of* 770 *Double Stars.*

By Sherburne Wesley Burnham, M.A.

(*Received June* 5; *read June* 9, 1882.)

Introduction.

The double-star observations which follow comprise 151 new pairs of which 570 measures have been made, and 770 pairs from the various catalogues of which there are about 1,900 individual measures. This work in the main was done between November 1, 1878, and the end of the year 1880, although a few measures were made in the early part of 1881, and a few in the beginning of the present year. During the greater part of 1881 I was away from Chicago (at the Washburn Observatory, Madison, Wis., and at the Lick Observatory, Mount Hamilton, Cal.), and, therefore, excepting a few recent observations, the work now presented was finished in the two years following its commencement.

Method of Observing.

The general method of making the measures has been already sufficiently described in the former series (*Memoirs* R.A.S. vol. xliv.), of which the present work is a continuation. It is only necessary to add that more care has been taken to have in all cases the line joining the eyes either parallel to the line between the stars measured, or at right angles to them. In my own

experience I have found this very important, not only giving better and more uniform readings of the angle, but enabling the observer to set the wires quicker and with greater apparent certainty. It should be stated that this has special reference to the measurement of close and faint objects, where the components are seen with more or less difficulty. It is not improbable that this attention to the position of the observer would be less important in measuring two bright objects, where the certain bisection of each would be an easy matter.

THE MICROMETER.

The micrometer attached to the 18½-inch Refractor has been briefly referred to in the introduction to the former measures. It works as well in the matter of illumination and otherwise as any of the old forms of micrometer which I am acquainted with. The bright-wire illumination has been invariably used. To provide against any lost motion, the micrometer screw is always turned in the same direction, and against the spiral springs attached to the frame carrying the moveable wire. Double distances have been measured in substantially all the observations. In the very few instances where this has not been done, owing to the great distance of the companion star, the omission has been stated in the notes. Ordinarily I have made four settings for the angle, and three measures on each side of the fixed wire for the distance. So far as I can judge, as good a mean is given as from a greater number. Certainly nothing is gained by taking a great many readings, and the loss of time in so doing is a matter of some consequence. After each setting for angle and distance, the wires are changed back and forth, perhaps 20° in angle, and changed several seconds in distance, so that each reading shall be entirely independent of the others.

In these measures I have noted the sidereal time, and also indicated in the last column by the Roman numerals the eyepiece employed. Ordinarily the highest power has been used which the steadiness of the air and the magnitude of the star would permit. It is a fact well known to double-star observers that some minute stars (principally below twelfth magnitude) will not bear much magnifying, even when the atmospheric conditions are the most favourable ; and it is not easy to tell in advance what will be the best power for any given object, and particularly for very unequal pairs.

The powers of the several micrometer eyepieces are as follows:—

Eyepiece.	Power.	Eyepiece.	Power.
I.	190	IV.	638
II.	292	V.	925
III.	390		

Eyepieces IV. and V. could only be used when the seeing was very good, and the air steadier than the average. Eyepiece I. has been rarely used, if at all, in these observations. The value of one revolution of the micrometer screw is 11″·420.

Observing Seat.

I wish to call attention to the excellent practical advantages of the observing seat described in *Monthly Notices* for March 1881, by Prof. George W. Hough, Director of the Dearborn Observatory. Its simplicity and ease of manipulation will be strong recommendations to astronomers who have used the cumbersome and complicated machines heretofore made. Such devices, with their cone-wheels, tracks, tangent-screws, chain-belts, gears, etc., and appliances for vertical and horizontal movement, may be very ingenious as mechanical contrivances and look well on paper, but for practical purposes in double-star work are worse than useless; and the observer, who wishes to make the most of his time with the telescope, cannot afford every ten or fifteen minutes during the evening to spend the time necessary to put such a chair in the proper position for an observation. It is not too much to say that any observing seat which cannot be changed from the proper place for one star to its place for another star of different altitude, and in another part of the heavens, in a quarter of a minute, will not be convenient and economical for any department of work requiring frequent changes. I have made several thousand measures by the aid of this seat and others like it (at the Washburn and Lick Observatories), and have found it for all kinds of actual work in this department so entirely satisfactory as to be nearly perfect.

Classes of Double Stars Observed.

The remarks in my first series of observations on the selection of stars for measurement will apply equally well here. In preparing a working list,

it was necessary that it should have a large proportion of comparatively wide and easy stars in order to provide work for poor nights, or when the air is not steady enough for the more close and interesting objects. In filling up this part of the list, I have endeavoured to select from the old catalogues of Struve, Herschel, South, and others, stars which have been partially or wholly neglected by late observers. The stars of this class do not usually prove to be of a very interesting character; but it is of some importance to ascertain what change, if any, has occurred in the last half-century. Prof. Ormond Stone, of the Cincinnati Observatory, has done a valuable work in this direction; but there are many stars yet requiring attention. For nights of the best definition, I have selected the more difficult binaries and other interesting stars, and particularly those which from the closeness and inequality of the components are rarely observed. It may be thought strange that I have not confined my measures to stars selected from my own catalogues. This I should have been glad to do, for measures of these would be more valuable than any other class of double stars, because of the stars themselves and the few observers who measure them; but it must be remembered that only a very small per centage of these thousand stars, much less than in any other double-star catalogue, can be measured on the poorer kind of nights. The stars discovered with the 6-inch can for the most part, even with this much larger instrument, be properly measured only under better than average atmospheric conditions.

In a general way it may be stated that on each night the stars measured were as difficult as could be observed under the circumstances, and, therefore, it may be understood that the very wide pairs were measured under the poorest conditions. With this explanation, it did not seem necessary to accompany the measures with notes of the seeing, etc. My intention at the beginning was to measure each star at least three times, but it was found impracticable, from the time and labour required to manage so large a dome, to finish the measures of each pair in any limited time, and consequently some of the pairs have only one or two measures.

The full aperture of the telescope has been used in all the observations. I have satisfied myself by experiments in this direction that nothing is gained under any circumstances by reducing the aperture of the instrument; and I have no doubt this is equally true of all first-class telescopes.

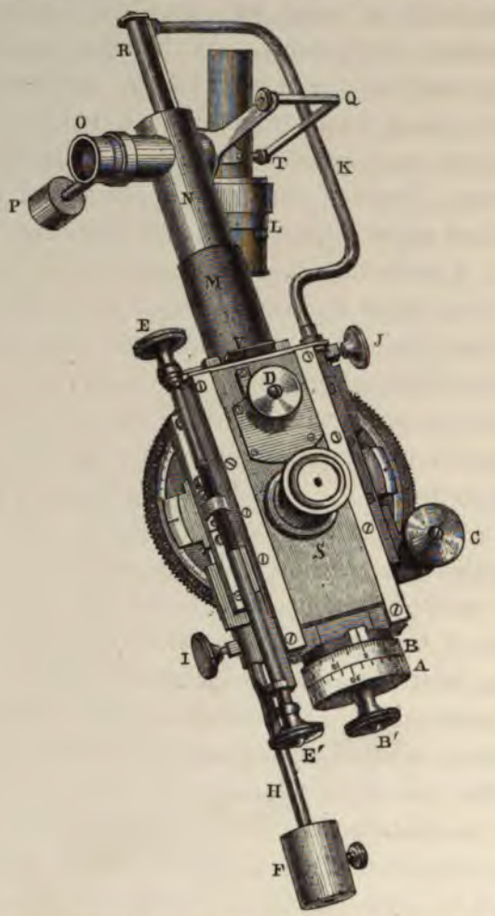
Mount Hamilton Observations.

Prof. E. S. Holden, of the Washburn Observatory, and myself went to the Lick Observatory, Mount Hamilton, Cal., in October 1881, for the purpose, among other things, of observing the Transit of *Mercury*, and while there I had an opportunity of using for a couple of weeks the 12-inch Clark refractor in double-star observations. As the rainy season had commenced at this time, there were but few good nights. Some new stars, however, were discovered, several of which were difficult naked-eye stars, and a few measures of other pairs were made. These results are given at the end of the Chicago measures. Some of the most important of the new stars were found on the last clear night I spent on Mount Hamilton, and were therefore measured but once. I endeavoured after my return to Chicago to make other measures, but as these stars are very difficult even with the larger instrument, and the weather during the past winter was very unfavourable most of the time, only a few additional measures were secured.

The micrometer, provided with the new form of bright-wire illumination, and some other recent improvements, worked so well in every respect that it was always a pleasure to use it. The following illustrated description of this micrometer is taken from *Monthly Notices* for March 1882.

In all my double-star measures I have uniformly used a bright-wire illumination, that method having been found by experience to be much superior to any form of bright field, and particularly in the observation of very close pairs and very faint companions which could only be seen with difficulty without any illumination at all. The Fraunhofer plan (which seems to have been the best in general use), of attaching the lamp to a hollow arm forming an angle of about 45° with the axis of the telescope, was always very objectionable and inconvenient, from the fact that to obtain a proper light on the wires it was necessary to change the place of the lamp with every change of the wires in position-angle, so as to allow the light to strike the wires approximately at right angles. For some years past I have given much attention, and made many experiments, with a view to the improvement of the micrometer in this respect. This resulted, while at the Washburn Observatory during the summer of 1881, in the execution of a plan for the "end" illumination of the Clark micrometer attached to the 15½-inch refractor of that Observatory. That device was fully described and illustrated in the *English Mechanic* for

September 16, 1881. This micrometer was regularly used for some months, and although the illuminating apparatus was somewhat roughly made, and intended only to demonstrate the practical success of this device, it was found to work so satisfactorily in every respect that the micrometer for the 12-inch refractor of the Lick Observatory was constructed after the same plan, and



was used by the writer for some weeks on Mount Hamilton, Cal., in the latter part of 1881. This illuminating apparatus is identical in principle with that previously described, but, as would be expected from the great skill and ingenuity of the firm of Alvan Clark & Sons, by whom it was made, the mechanical construction generally is vastly improved, and the convenience and usefulness of the micrometer increased thereby.

The accompanying illustration is engraved from a photograph of the Lick Observatory micrometer, the construction of which will be understood by a brief description.

The micrometer is of the usual form made by the Clarks, B being the graduated head of the micrometer-screw, and A another graduated head turning on the same axis for giving the whole revolutions of the screw; C is the head of a pinion attached to the plate under the micrometer-box, and gearing into the teeth of the rigid circular plate containing the position circle, for moving the wires in position angle; D is the head of another small pinion for sliding the eyepiece over the wires; E E′ are heads of the bisecting-screw for moving the whole system of wires and the box S in a direction parallel to the micrometer-screw, and at right angles to the wires. The light from the lamp L is reflected by a mirror in N, and passes down that tube and through M, and then through a hole in the end of the box to the wires. A condensing lens is placed in N, for the purpose of concentrating the light on the wires. On the opposite side of the wires, towards the micrometer head, a small reflector is placed which reflects the light back, thereby symmetrically illuminating the wires on both sides. The lamp swings freely on its axis in the line of O T, but always maintains a vertical position, whatever may be the direction of the wires or the pointing of the telescope. The tube N, with the lamp and its attachments, has anaxle R supported by the fixed arm K. The bearings T, and axle of the lamp, are kept always horizontal by the weight of the counterpoise P. The tube M is fixed to the micrometer box and projects loosely over N far enough to allow for the necessary movement of the box by the bisecting-screw E. The supporting arm K is attached by the set-screw J, not to the box, but to the plate underneath it, so that the weight moved by the bisecting-screw is not increased at all by the illuminating apparatus. Attached to the same plate, on the opposite side by a set-screw I, is the rod H, bent so as to be thrown forward out of the way of E′ and B, with a weight F to balance the weight of the lamp attachments. The whole device can be instantly detached when desired, by loosening the screws I and J. In the tube M is a slot V, in which is placed a slip of red or other coloured glass, held in any desired place by a light spring pressing against it. All or any part of the light can be made to pass through the coloured medium. The mirror in N is attached to a tube which slides into the tube O. By turning this tube by the milled edge projecting at O, the inclination of the

mirror may be varied to any extent, and the light reduced from the maximum amount until the wires become invisible. By turning the mirror 90° or more the light is entirely shut off. It will be seen that the lamp can revolve freely through the bent arm Q ; and the whole moveable part of the device, lamp, arm Q, and counterpoise P, can turn through the supporting arm K, the lamp at all times remaining vertical, and in exactly the same position with respect to the wires. It might at first be supposed that the lamp, or some of the parts, would be in the way of the observer. I have never found it so in practice, and, although it is but a few seconds' work to either attach or detach it, I have very rarely removed it, whatever might have been the use of the telescope at the time.

It is important to preserve the relative positions of the micrometer-head, bisecting-screw, and pinion C, as here shown. No other arrangement will be as convenient. In every possible position of the micrometer, the necessary use of both hands at the same time will be found to be convenient and easy for the observer. Naturally the more delicate motions of the micrometer-screw and the pinion will be effected by the right hand, and the corresponding movement of the bisecting-screw by the left hand. When the micrometer-box is anywhere near a horizontal position with respect to the observer (the wires at right angles to the line joining the eyes) C and E are used by the right and left hands respectively in measuring angles, and B′ and E in measuring distances. When the box is more nearly vertical with respect to the observer, the head E′ of the bisecting-screw will be worked by the left hand in each case. The convenience and practical value of this arrangement can only be appreciated by one who has used the old plans, and then tried this.

With respect to the practical working of the illumination, I will briefly say that it has proved a complete success in every respect. Any object that can be seen under any circumstances, however faint, can be well and accurately measured. There is no such thing as a star too faint for measurement, if it can be seen at all. A very feeble light is sufficient to illuminate the wires perfectly for any object. I believe far better results can be obtained by the use of bright wires in a large part of the most desirable and important double-star work, than is possible by the same observer using a bright field, and that sooner or later it will be generally used in all micrometrical observations.

The value of a revolution of a screw of this new micrometer was ascertained by direct measures of the following stars:—

Star.	Assumed Distance.	One Revolution.
Aldebaran and companion	115″·05	14″·04
η Tauri „ „	117·11	14·10
θ^1 and θ^2 Tauri	337·38	14·08
θ^1 and θ^2 Tauri	...	14·05
θ^1 and θ^2 Tauri	...	14·11
θ^1 and θ^2 Tauri, dif. decl.	327·66	14·08
κ^1 and κ^2 Tauri	339·65	14·03
κ^1 and κ^2 Tauri	...	14·04
κ^1 and κ^2 Tauri	...	14·10
κ^1 and κ^2 Tauri, dif. decl.	340·03	14·14
56 Andromedæ and companion	183·78	14·05
θ^1 and θ^2 Orionis	135·61	14·11
ρ and 94 Piscium, dif. decl...	256·68	14·08
Atlas and Pleione	290·15	14·06
Atlas and Alcyone	171·30	14·21
19 and 20 Tauri	352·00	14·10
	Mean=14·086	

The powers of the several micrometer eyepieces were approximately measured as follows:—

Eyepiece.	Power.	Eyepiece.	Power.
I.	160	IV.	545
II.	240	V.	700
III.	370	VI.	1400

New Double Stars.

The present catalogue of new stars contains about the usual average of bright or naked-eye stars found in my other lists. The following new pairs are naked-eye stars:—

β	Star.	Distance.	β	Star.	Distance.
874	5 Persei.	5″·60	940	52 Hydræ.	4″·00
875	9 Persei.	11·58	946	B.A.C. 5248.	1·31
877	γ Fornacis.	11·53	947	β Scorpii.	0·91
878	66 Arietis.	1·10	954	54 Herculis.	2·56
881	46 Eridani.	1·47	962	26 Draconis.	1·37
888	σ Aurigæ.	7·91	966	B.A.C. 6301.	0·62
893	B.A.C. 1935.	17·60	968	ζ Lyræ.	43·37
901	65 Aurigæ.	10·56	980	η Cygni.	7·07
913	40 Leo Minoris.	10·92	983	B.A.C. 6966.	0·86
918	L. 22496	7·45	990	κ Pegasi.	0·27
924	31 Virginis.	3·56	997	R. 6203	5·52
925	R. 2937.	7·11	1000	ω Andromedæ.	2·29
929	48 Virginis.	0·48	1008	126 Tauri.	0·27
930	B.A.C. 4389	2·68	1009	η Geminorum.	0·96
932	Virginis 550.	0·47	1010	τ Geminorum.	1·87
935	86 Virginis.	1·61 AB 1·72 CD	1014	δ Sculptoris.	3·36

The following stars, previously catalogued, have been found to be more closely double:—

β	Double Star.	New Companion.	Old Companion.
876	Σ 258.	1″·19	6″·01 70·31
877	H. 2165 (γ Fornacis).	11·53	48·85
880	Σ 439.	0·45	23·70
886	Σ 687.	0·90	17·51 48·48
889	Σ 707.	1·11	18·04
891	H. 3275.	9·89	52·82
895	Σ 888.	0·27	2·83
933	H. 2661.	1·88	34·48
935	Σ 1780 *rej.* (86 Virginis).	1·61 1·72	26·94

β	Double Star.	New Companion.	Old Companion.
		″	″
947	Ψ. III. 7 (β Scorpii).	0·91	13·50
948	Σ 2005 *rej.*	1·46	28·54
968	Σ 38. App. I. (ζ Lyræ).	43·37	43·48
973	Σ 2435.	1·43	10·73
975	OΣ 367.	0·77	33·42
980	H. 1455 (η Cygni).	7·07	46·17
988	S 752.	2·32	106·17
990	Σ 2824 (κ Pegasi).	0·27	11·76
1014	H. 3216 (ι Sculptoris).	3·36	74·31

The reference number attached to the new stars is continued as heretofore from the preceding catalogues, which have been published from time to time, as follows:—

First Catalogue.	Nos.	1 to 81.	*Monthly Notices* R.A.S.	March 1873
Second „	„	82 to 106.	„ „ „	May 1873
Third „	„	107 to 182.	„ „ „	December 1873
Fourth „	„	183 to 229.	„ „ „	June 1874
Fifth „	„	230 to 300.	„ „ „	November 1874
Sixth „	„	301 to 390.	*Astronomische Nachrichten.*	No. 2062
Seventh „	„	391 to 436.	„ „	„ 2103
Eighth „	„	437 to 452.	*American Journal of Science.*	July 1877
Ninth „	„	453 to 482.	*Monthly Notices* R.A.S.	December 1877
Tenth „	„	483 to 733.	*Memoirs* R.A.S.	Vol. XLIV.
Eleventh „	„	734 to 775.	Report to the Trustees of the James Lick Trust.	1880
Twelfth „	„	776 to 863.	Publications of the Washburn Observatory.	1882
Thirteenth „	„	864 to 1013.	The present Catalogue.	

The measures of these stars, other than my own, are principally by the late Baron DEMBOWSKI. It may be stated here that the greater part of the first five hundred stars mentioned above have been thoroughly measured by DEMBOWSKI on three or more nights each. These observations were sent to me from time to time by that distinguished observer, and subsequently the mean results in collected form. In the following pages I have quoted those

measures whenever I have observed the same stars. Those observations, amounting altogether to about two thousand measures, with few exceptions have never been published. It is gratifying to know that the great work of that lamented astronomer is to be collected and published under the direction of M. SCHIAPARELLI, of the Royal Observatory of Milan. When this is done, the immense amount of work accomplished by that most eminent astronomer and its special and lasting value will be better understood and appreciated. It is earnestly hoped that the publication will not be much longer delayed; for the name of DEMBOWSKI is inseparably connected with this branch of astronomical research, and his measures are indispensable in discussing the movements of double stars.

The present catalogue will conclude my astronomical work, at least so far as any regular or systematic observations are concerned. In a field so infinitely large, one can accomplish but little at the most, and how much, or how little, the astronomers of a few centuries hence can perhaps best decide. Of the thousand new double stars I have been able to contribute, it is certain that many, if not a large proportion, will be worthy of the attention of the observers and telescopes of the future; and I trust that these early measures will then have a value they may be regarded as lacking now. At this time I may venture to claim that my work in this field has been prosecuted with some enthusiasm, and for its own sake only, and that my interest has not been divided among several specialties. I trust that other observers in following up the work thus commenced will derive as much pleasure as I have taken in doing my portion of it.

In conclusion, I wish to express my grateful appreciation of the uniform kindness and courtesy of Prof. GEORGE W. HOUGH, the present Director of the Dearborn Observatory. I have received at his hands at all times every facility and assistance in doing this work, and am under many obligations to him. I am glad to be able to state that Prof. HOUGH is giving some portion of his time, when the instrument is not required for the regular planet observations, to the measurement of double stars, and has discovered some interesting and difficult new pairs.

CHICAGO:
May 22, 1882.

ABBREVIATIONS

USED IN THE NOTES TO THE MEASURES.

β	denotes	. .	BURNHAM.
Cin.	„	. .	O. STONE and CINCINNATI OBSERVERS.
De.	„	. .	DEMBOWSKI.
Du.	„	. .	DUNÉR.
En.	„	. .	ENGELMANN.
Gl.	„	. .	GLEDHILL.
Hl	„	. .	HERSCHEL I.
H.	„	. .	HERSCHEL II.
Hl.	„	. .	HALL.
J.	„	. .	JACOB.
Je.	„	. .	JEDRZEJEWICZ.
Kn.	„	. .	KNOTT.
Ma.	„	. .	MADLER.
Mh.	„	. .	MITCHELL.
O Σ	„	. .	OTTO STRUVE.
Σ	„	. .	STRUVE.
Sc.	„	. .	SECCHI.
Sbp.	„	. .	SCHIAPARELLI.
S.	„	. .	SOUTH.
Sh.	„	. .	SOUTH and HERSCHEL.
Wn.	„	. .	WINNECKE.

Catalogue of 151 *New Double Stars discovered at Chicago from November* 1878 *to December* 1880, *with the* 18½*-inch Refractor of the Dearborn Observatory.*

β 864. D.M. (34°) 12.

R.A. $0^h\ 6^m\ 40^s$
Decl. + 34° 40′

1880·675	138°·8	1″·27	8·8...11·8	21 : 30	
1880·782	140·3	1·70	9·0...13	22 : 20	II.
1880·810	135·7	1·70	—	22 : 10	II.
1880·824	139·6	1·74	8·8...12	22 : 25	III.
1880·77	138·6	1·60	8·9...12·3		

β 865. D.M. (42°) 161.

R.A. $0^h\ 37^m\ 14^s$
Decl. + 42° 35′

1880·728	196°·8	1″·15	8·5...9·3	21 : 00	III.
1880·775	198·2	1·15	8·5...8·7	22 : 00	III.
1880·782	198·2	1·23	8·5...9·0	22 : 30	III.
1880·824	196·6	1·32	8·5...8·8	21 : 35	III.
1880·78	197·4	1·21	8·5...9·0		

β 866. D.M. (42°) 166.

R.A. $0^h\ 38^m\ 5^s$
Decl. + 42° 35′

This is in a low-power field with the last pair.

1880·728	67°·9	1″·31	9·0...9·1	21 : 00	III.
1880·775	68·5	1·11	9·3...9·3	22 : 05	III.
1880·782	68·8	1·23	9·5...9·5	22 : 40	III.
1880·824	67·6	1·40	9·0...9·0	21 : 45	IV.
1880·78	68·2	1·26	9·2...9·2		

β 867. L. 1719.

R.A. $0^h\ 53^m\ 56^s$
Decl. + 11° 17′

1878·944	171°·1	0″·99	8·0...8·5	1 : 30	III.
1880·728	176·7	0·86	8·0...8·6	22 : 05	IV.
1880·947	176·7	1·03	8·4...8·7	1 : 05	III.
1880·21	174·8	0·96	8·1...8·6		

β 868. O. Arg. 1156.

R.A. $1^h\ 2^m\ 54^s$
Decl. + 51° 24′

There is a 10 mag. star in the direction of 12°.

1880·636	232°·3	9″·29	8·0...10·5	20 : 15	I.
1880·678	233·5	9·41	8·0... 9·3	—	I.
1880·703	234·7	9·44	—	21 : 40	II.
1880·709	234·9	9·32	8·0... 9·5	21 : 35	II.
1880·68	233·8	9·37	8·0... 9·8		

β 869. L. 2935.

R.A. $1^h\ 30^m\ 3^s$
Decl. + 3° 42′

1878·942	197°·3	4″·97	7·8...12·5	1 : 15	II.
1878·980	199·2	5·42	8·0...12·0	0 : 30	II.
1880·722	199·7	4·86	—	22 : 40	II.
1880·725	196·9	5·08	8·0...11·0	23 : 20	III.
1880·947	197·9	5·30	8·0...11·5	1 : 35	III.
1880·05	198·2	5·13	8·0...11·7		

β 870. B.A.C. 525.

R.A. $1^h\ 36^m\ 22^s$
Decl. + 56° 56′

This star, given as 7 mag. in B.A.C.

and 6·4 in D.M., is strangely wanting in many of the star catalogues.

1880·802	67°·6	1″·06	6·8...8·5	22 : 35	III.*
1880·813	69·3	1·15	7·0...7·5 ?	22 : 50	II.†
1880·824	69·6	0·85	6·8...9 0	21 : 20	IV.
1880·81	68·9	1·02	6·9...8·3		

* Poor seeing. † Very poor.

β 871. W.I. 729.

R.A. 1ʰ 41ᵐ 49ˢ
Decl. − 1° 33′

1878·944	352°·6	1″·75	8·5...9·0	0 : 50	II.
1878·980	350·7	1·99	8·0...8·7	0 : 35	II.
1880·666	352·5	2·13	8·5...9·5	0 : 10	III.
1880·947	354·6	1·67	8·5...9·0	1 : 50	III.
1879·88	352·6	1·88	8·4...9·0		

β 872. L. 3694.

R.A. 1ʰ 54ᵐ 28ˢ
Decl. + 32° 44′

This pair is 1ᵐ 28ˢ *p ε Trianguli.*

1880·709	182°·2	5″·72	8·0...11·5	21 : 50	II.
1880·725	182·4	5·12	8·2...11·5	0 : 20	III.
1880·728	182·4	5·16	8·3...11·5	22 : 50	II.
1880·775	181·5	4·99	8·0...12·0	21 : 45	II.
1880·75	182·1	5·25	8·1...11·6		

β 873. R. 597.

R.A. 1ʰ 56ᵐ 6ˢ
Decl. + 63° 49′

1880·703	33°·4	2″·20	7·0...10·0	22 : 00	II.
1880·709	30·4	1·95	7·5...10·5	21 : 00	II.
1880·775	27·3	1·87	7·0...10·5	22 : 15	III.
1880·802	25·2	2·09	6·8...11·0	22 : 10	II.
1880·813	31·6	2·14	8·0...12·0	22 : 15	III.
1880·824	26·7	1·90	7·8...11 5	21 : 10	III.
1880·77	29·1	2·03	7·3...10·9		

β 874. 5 *Persei.*

R.A. 2ʰ 3ᵐ 18ˢ
Decl. + 57° 5′

A very minute companion, but not difficult under good conditions.

1880·589	275°·4	5″·32	6·7...12·0	20 : 25	II.
1880·592	271·1	5·85	6·3...12·5	20 : 40	II.
1880·613	274·2	5·62	6·5...13·0	22 : 25	II.
1880·60	273·6	5·60	6·5...12·5		

β 875. 9 *Persei.*

R.A. 2ʰ 13ᵐ 59ˢ
Decl. + 55° 18′

Similar to the last, but a little easier, from the greater distance of the companion.

1880·592	162°·5	11″·66	6 0...12·0	20 : 25	II.
1880·613	161·5	11·60	5·0...12·5	22 : 30	II.
1880·627	162·0	11·49	5·5...12·5	23 : 00	II.
1880·61	162·0	11·58	5·5...12·3		

β 876. (AC=Σ 258.)

R.A. 2ʰ 16ᵐ 46ˢ
Decl. + 32° 58′

The principal star of STRUVE's pair has a very minute and close companion.

1878·909	233°·0	1″·30	8·5...13.0	23 : 50	
1880·063	236·9	1·06	...12·5	4 : 25	
1880·725	235·6	0·94	...11·8	0 : 30	II.
1880·824	236·2	1·47	...12·0	22 : 40	III.
1880·13	235·4	1·19	8·5...12·3		

C and D.

1878·909	28°·8	6″·16	10·5...10·5	23 : 40	II.
1880·063	28·4	6·07	9·0... 9·3	4 : 15	II.
1880·725	28·7	5·97	9·3... 9·4	0 : 30	III.
1880·728	28·9	5·33	9·0... 9·3	22 : 30	II.

A and C.

1878·909	145°·4	70″·35	—	0 : 00	II.
1880·063	145·3	70·27	—	4 : 20	II.

Struve gives the magnitudes of A, C and D as 7·5, 9·5 and 10·2 respectively. There is but little evidence of change in the old companions.

C and D.

1831·53	26°·8	5″·89	Σ	3 nights.
1880·13	28·7	6·01	β	4 „

A and C.

1832·18	143°·6	70″·26	Σ	2 nights.
1879·49	145·4	70·31	β	2 „

β 877. γ *Fornacis.*

R.A. 2h 44m 33s
Decl. − 25° 3′

The principal star with the distant companion were catalogued as a wide pair by Herschel. In measuring this, a much closer and more difficult attendant was detected.

A and B.

1880·911	145°·4	11″·92	6...13·0	2 : 50	II.
1880·922	143·9	12·04	...12·5	1 : 40	III.
1880·931	143·4	11·20	...13·0	1 : 20	III.
1880·947	142·6	10·95	...13·0	1 : 20	III.
1880·93	144·4	11·53	...13		

A and C (=H. 2165).

1879·953	157°·5	49″·15	...10·5	3 : 00	II.
1880·911	157·2	48·51	...11·5	3 : 00	II.
1880·922	156·1	49·45	...11·5	1 : 45	II.
1880·942	157·2	48·27	—	—	II.*
1880·68	157·0	48·85	...11·2		

* Poor seeing.

Herschel gives the angle of the distant star 169°·4, with estimated distance of 45″. The above are the only measures since.

β 878. 66 *Arietis.*

R.A. 3h 21m 26s
Decl. + 22° 23′

A difficult pair from the minuteness of the companion.

1881·044	76°·5	1″·06	6·0...11·5	4 : 15	IV.
1881·074	79·4	1·15	6·0...13·0	4 : 00	III.
1881·06	78·0	1·10	6·0...12·2		

β 879. B.A.C. 1075.

R.A. 3h 22m 3s
Decl. + 10° 58′

1878·942	70°·3	25″·31	6·5...12·13	—	III.
1878·980	71·4	24·22	6·5...12·13	3 : 10	II.
1879·033	71·6	24·42	6·5...12·13	2 : 40	II.
1878·98	71·1	24·65	6·5...12·5		

β 880. (AC=Σ 439.)

R.A. 3h 37m 3s
Decl. + 31° 47′

A and B.

1880·725	353°·0	0″·37	8·5...8·7	1 : 00	V.
1881·074	354·4	0·54	9·0...9·0	4 : 20	IV.
1880·90	353·7	0·45	8·7...8·9		

AB and C.

1878·917	37°·9	23″·87	8·0...8·7	1 : 10	IV.
1880·725	38·0	23·53	...9·5	1 : 00	V.

The larger star of Struve's pair is a close and difficult double. There is very little change in the distant star, as will be seen from the following, which are all the measures of this companion:

1830·99	38°·1	23″·20	Σ	2 nights.
1879·61	37·3	23·28	Cin.	1 night.
1879·82	38·0	23·70	β	2 nights.

β 881. 46 *Eridani.*

R.A. 4h 28m 4s
Decl. − 7° 0′

A fine pair, and not difficult.

1878·931	57°·1	1″·03	6·0... 9·5	4 : 35	III.
1879·000	56·8	1·37	6·0...10·5	4 : 15	V.
1879·066	57·4	1·43	6·0...11·5	4 : 45	III.
1879·102	56·9	1·59	6·0...11·5	5 : 30	IV.
1879·02	57·0	1·47	6·0...10·8		

β 882. *Anon.*

R.A. 4h 32m 14s
Decl. − 11° 23′

The *n. p.* of two small stars in the same field. Only found in the Berlin Catalogue.

1880·079	231°·6	2″·04	8·8...10.0	4 : 50	II.

β 883. L. 9091.

R.A. 4h 44m 33s
Decl. + 10° 52′

A very difficult triple star, of which I was able to get only a single measure:

A and B.

1879·00	17°·5	0″·35	7·0...7·0	5 : 15	V.

AB and C.

1879·000	148°·5	18″·35	...14	5 : 25	III.

β 884. L. 9534.

R.A. 4h 57m 22s
Decl. − 12° 37′

1879·066	200°·7	0″·5 ±	8·0...8·0	5 : 00	III.
1879·107	197·4	0·54	8·0...8·0	5 : 30	IV.
1879·09	199·0	0·54	8·0...8·0		

β 885. L. 9758.

R.A. 5h 4m 54s
Decl. − 1° 55′

1880·104	16°·8	0′·84	8·0...8·0	5 : 05	III.
1881·137	13·9	0·72	8·5...8·5	5 : 35	III.
1881·151	197·7	0·56	8·5...8·7	5 : 35	IV.
1880·80	16·1	0·71	8·3...8·4		

β 885*a*. L. 9823.

R.A. 5h 10m 0s
Decl. + 37° 31′

1880·046	68°·6	2″·16	7·5... 9·0	5 : 10	II.
1880·063	69·4	2·24	7·5... 9·0	7 : 20	III.
1880·125	66·2	2·18	8·0... 9·3	7 : 10	II.
1880·142	71·1	2·19	7·5...10·0	8 : 00	II.
1880·145	71·5	2·55	7·5...10·0	8 : 35	II.
1880·725	69·2	2·56	7·5... 9·5	2 : 40	III.
1880·21	69·3	2·31	7·5...9·5		

β 886. (ABC=Σ 687.)

R.A. 5h 14m 24s
Decl. + 33° 41′

A and B.

1882·219	68°·6	17″·67	8·6...8·6	8 : 10	III.
1882·239	68·6	17·46	8·3...8·5	8 : 10	III.
1882·244	68·3	17·39	8·5...8·8	7 : 50	II.

A and C.

1882·239	153°·1	48″·63	...8·6	8 : 15	III.
1882·244	153·3	48·34	...8.9	7 : 55	II.

C and D.

1882·219	246°·9	0″·90	8·5...10·0	8 : 05	III.

The wide triangle was observed by Σ, but he failed to notice the duplicity of the third star. A comparison of the measures would seem to indicate no material change in the relative positions of the bright stars.

1829·24	67°·6	17″·17	Σ	2 nights	AB.
1882·23	68·5	17·51	β	3 „	
1829·24	153·5	48·73	Σ	2 „	AC.
1882·24	153·2	48·48	β	2 „	

β 887. D.M. (33°) 1026.

R.A. 5h 14m 53s
Decl. + 33° 18′

A and B.

1882·219	193°6	1″12	9·0...10·5	8 : 20	III.
1882·239	195·0	0·89	—	8 : 25	III.
1882·221	94·3	1·00			

A and C.

1882·219	331°8	10″73	...11·0	8 : 25	III.
1882·239	334·7	10·72	...12·0	8 : 20	III.
1882·244	331·9	10·23	...12·0	8 : 00	II.
1882·24	332·8	10·56	...12		

There is another faint companion in the direction of 109°, about the same distance as C.

β 888. σ *Aurigæ*.

R.A. 5h 16m 29s
Decl. + 37° 17′

A faint companion, but not difficult.

1880·123	169°5	7″98	6·0...12·0	6 : 45	II.
1880·134	171·9				
1880·142	171·2	7·95	6·0...12·0	7 : 45	II.
1880·145	171·3	7·79	—	8 : 20	II.
1880·14	171·0	7·91	6·0...12·0		

β 889. (AC=Σ 707.)

R.A. 5h 20m 10s
Decl. + 34° 19′

The principal star of STRUVE'S pair is double. The distant companion, D, had been noted by me with the 6-inch refractor previously (*Monthly Notices*, June 1874).

A and B.

1878·909	223°5	1″11	8·5...10·0	2 : 10	III.

A and C.

1878·909	131°4	18″04	...10·0	2 : 20	III.

A and D.

1878·909	200°7	27″77	...11·5	2 : 30	III.

The STRUVE companion appears to be fixed:

1830·75	131°6	18″29	Σ	2 nights.

β 890. L. 10175.

R.A. 5h 20m 49s
Decl. + 37° 41′

1880·123	285°8	1″12	8·3...8·5	6 : 50	II.
1880·142	286·3	1·31	8·5...9·0	7 : 50	II.
1880·145	287·7	1·07	8·5...9·0	5 : 40	II.
1880·14	286·6	1·17	8·4...8·8		

β 891. AC=OΣ (App.) 64=H. 3275.

R.A. 5h 22m 50s
Decl. + 18° 19′

A and B.

1879·104	121°6	9″89	7·0...13·0	5 : 40	III.

A and C.

1879·104	20°7	53″02	7·0...7·0	5 : 50	III.
1880·164	23·4	52·63	8·0...8·0	—	II.

The bright stars do not appear to have changed. The following are all the measures:

1874·42	20°6	52″86	De.	2 nights.
1879·63	22·0	52·82	β	2 „

β 892. D.M. (17°) 1006.

R.A. 5h 40m 38s
Decl. + 17° 41′

An unequal and difficult pair in the field with 130 *Tauri*, 12s *f*.

1879·104	271°0	1″21	8·7...13·0	6 : 10	III.
1879·175	274·6	1·17	9·0...13·0	6 : 05	II.
1879·09	272·8	1·19	8·9...13·0		

β 893. B.A.C. 1935.

R.A. 5h 56m 49s
Decl. + 37° 58′

Wide unequal pair near 40 *Aurigæ*. HEIS, 6·7 mag.

1878·893	127°·3	17″·65	6·0...12·0	
1878·906	128·7	17·55	6·5...13·0	2:50
1878·90	128·0	17·60	6·2...12·5	

β 894. D.M. (19°) 1285.

R.A. 6h 9m 27s
Decl. + 19° 3′

In ARG. 7·6 mag.

1881·137	137°·3	5″·13	8·5...12·5	6:40	II.
1881·145	138·7	5·16	8·0...12·5	6:55	III.
1881·14	138·0	5·14	8·2...12·5		

β 895. (AC=Σ 888.)

R.A. 6h 12m 23s
Decl. + 28° 29′

HERSCHEL in 1828 (Seventh Catalogue) noted 'the large star suspected to be a close double.' I examined this star in 1873 with the 6-inch, and on one occasion thought there might be a little elongation in the direction of STRUVE'S companion, but in December 1875, on a first-class night, the principal star appeared to be perfectly round. In 1879 it was again looked at with the 18½-inch, and at once seen to be an excessively close pair. It must have been much easier than it is now, to have been even suspected with the large reflector, and may prove to be in rapid motion. It was not separated with the highest power.

A and B.

1879·220	133°·3	0″·27	7·5...7·5	7:25	V.

AB and C.

1879·220	250°·3	2″·83	...9·5	7:35	III.

STRUVE'S companion appears to have remained fixed.

1831·22	246°·2	2″·70	Σ	3 nights.
1857·16	250·8	2·77	Se.	1 night.

β 896. L. 12414.

R.A. 6h 23m 48s
Decl. + 32° 15′

A difficult triple.

A and B.

1879·000	199°·3	0″·89	7·0...10·0	7:00	IV.

AB and C.

1879·000	213°·7	18″·32	...13·0	7:10	IV.
1880·125	207·9	18·56	...13·0	8:20	III.
1879·56	210·8	18·44	...13·0		

β 897. *Monocerotis* 97.

R.A. 6h 44m 42s
Decl. − 0° 23′

1879·104	31°·2	5″·71	6·5...12·0	6:45	III.
1879·142	29·6	5·62	6·5...12·0	6:15	II.
1879·178	31·9	5·46	6·8...12·0	6:10	II.
1879·14	30·9	5·60	6·6...12·0		

β 898. O. ARG. 5753.

R.A. 6h 45m 0s
Decl. − 15° 53′

A quadruple star in the neighbourhood of *Sirius*.

A and B.

1879·184	355°·3	2″·94	7·5...12·0	6:20	II.
1879·220	358·7	3·48	7·5...11·0	7:50	III.
1880·079	356·3	2·79	8·0...11.0	—	III.
1880·102	352·1	2·48	8·0...11·5	—	III.
1880·162	358·4	3·05	8·2...·0·8	7:50	III.
1879·75	356·2	2·95	7·8...11·3		

C and D.

1879·184	270°3	1″45	9·0...10·0	6 : 30	III.
1879·220	272·5	1·53	10·0...11·0	8 : 00	III.
1880·162	272·4	1·64	10·3...10·8	7 : 50	II.
1879·52	271·7	1·54	9·8...10·6		

A and C.

1879·220	282°1	96″33	—	7 : 55	III.
1880·162	284·2	96·67	—	7 : 50	III.
1879·69	283·1	96·50			

β 899. W. vi. 1526.

R.A. 6h 52m 9s
Decl. + 18° 53′

A wide triple, the larger and middle star of which is a close double.

A and B.

1879·142	81°4	0″68	9·0...9·0	6 : 50	III.

AB and C.

1879·142	174°4	24″19	...10	7 : 00	III.
1879·145	174·0	23·95	—	6 : 45	II.
1879·14	174·2	24·07	...10		

AB and D.

1879·142	48°3	40″36	...9·0	7 : 05	III.
1879·145	47·9	40·56	...9·0	6 : 50	II.
1879·14	48·1	40·46	...9·0		

β 900. L. 13688.

R.A. 6h 58m 33s
Decl. + 21° 11′

Very unequal pair, about 40′ *n. f.* ζ *Geminorum.*

1880·189	271°5	1″52	8·0...12·0	8 : 00	II.
1880·214	273·8	1·64	8·5...11·5	7 : 45	II.
1880·20	272·6	1·58	8·2...11·7		

β 901. 65 *Aurigæ.*

R.A. 7h 14m 2s
Decl. + 36° 59′

Two very minute companions:

A and B.

1878·900	8°6	10″28	6·0...12·0	2 : 50	
1878·906	8·1	10·45	5·5...13·0	3 : 45	
1880·125	6·9	10·96	6·0...12·0	7 : 15	
1879·31	7·9	10·56	5·8...12·3		

A and C.

1878·900	26°8	36″10	...13·0	2 : 50	
1880·125	26·8	36·00	...12·5	8 : 40	
1879·51	26·8	36·05	...12·7		

β 902. L. 15575.

R.A. 7h 52m 22s
Decl. − 10° 34′

The single measure of this unequal pair was made under poor conditions.

1879·184	247°1	1″33	8·0...11·0	8 : 15	II.

β 903. L. 15768.

R.A. 7h 58m 9s
Decl. − 1° 31′

1879·104	35°2	1″32	7·6...9·0	7 : 50	II.
1879·170	36·3	1·26	7·5...9·0	7 : 15	III.
1879·200	28·8	1·60	8·0...9·5	—	II.
1880·236	34·6	1·48	8·0...9·5	7 : 45	II.
1880·274	33·4	1·70	8·0...9·5	8 : 50	II.
1879·60	33·7	1·47	7·8...9·3		

β 904. *Anon.*

R.A. 8h 8m ±
Decl. − 5° 20′ ±

In a cluster, and near H. 2435. Not identified in any star catalogue.

1880·030	79°9	3″12	8·3... 9·5	7 : 40	II.
1880·167	82·8	2·83	8·5...10·5	—	Ii.
1880·211	81·1	3·27	—	8 : 00	II.
1880·236	81·3	3·27	8·3...10·0	7 : 55	II.
1880·16	81·3	3·12	8·4...10·0		

β 905. O. Arg. 8288.

R.A. 8h 10m 59s
Decl. − 15° 57′

1879·184	13°·3	3″·84	7·5...10·5	—	II.
1879·192	11·5	3·77	7·8...10·8	—	II.
1880·226	12·1	3·68	8·0...10·0	8 : 25	II.
1880·266	11·7	3·69	8·0...10·0	8 : 40	II.
1879·72	12·2	3·75	7·8...10·4		

β 906. L. 16259.

R.A. 8h 11m 23s
Decl. − 15° 52′

Near the preceding pair.

1879·184	186°·9	3″·51	8·0 ..10·8	8 : 50	
1879·192	189·3	3·18	8·3...11·0	8 : 35	
1880·226	184·6	3·61	8·2...10·5	8 : 15	II.
1880·266	187·5	3·51	8·5...10·8	8 : 50	II.
1879·97	187·1	3·45	8·2...10·8		

β 907. *Anon.*

R.A. 8h 14m 2s
Decl. − 12° 28′

Unequal and close pair, in the field with 7 mag. star, 12s *f.* and 99″ *s.*

1879·206	57°·4	0″·75	8·5...11·0	8 : 20	III.
1880·266	58·3	0·90	8·5...10·5	8 : 30	II.
1879·74	57·8	0·82	8·5...10·7		

β 908. Lamont 547.

R.A. 9h 8m 25s
Decl. − 7° 48′

A and BC.

1880·236	184°·6	60″·38	9·0...9·2	9 : 20	II.
1880·266	184·7	60·74	8·9...9·0	9 : 10	II.
1880·25	184·6	60·56	9·0...9·1		

B and C.

1880·266	235°·3	0″·78	9·0...11·5	9 : 10	II.
1880·274	235·4	0·82	9·5...10·0	9 : 30	III.
1880·320	233·1	0·86	9·0...11·5	10 : 00	II.
1880·29	234·6	0·82	9·2...11.0		

A wide pair, the smaller component of which is closely double. There is a fourth star, 12·5 mag. in the direction of 222°·6 from A.

β 909. L. 18714.

R.A. 9h 25m 25s
Decl. + 22° 24′

1879·066	91°·1	5″·63	7·0...11·0	10 : 00	II.
1879·189	90·7	5·88	7·0...11·8	10 : 00	II.
1880·184	93·7	5·48	7·5...13·0	9 : 10	II.
1879·48	91·5	5·66	7·2...12·0		

β 910. L. 18800.

R.A. 9h 27m 10s
Decl. − 13° 28′

1879·134	306°·3	6″·86	7·5...10·5	0 : 40	III.
1880·226	303·3	6·73	8·0...10·0	9 : 50	II.
1880·269	305·0	6·93	—	—	II.
1879·87	304·9	6·84	7·7...10·2		

β 911. L. 19780.

R.A. 10h 2m 42s
Decl. − 19° 12′

This pair is 61s *f.* β 218, and 90″ *s.* In L. 7 mag.

A and B.

1880·236	312°·0	4″·87	7·0...11·5	10 : 15	II.
1880·274	310·9	4·64	8·0...11·0	10 : 10	II.
1880·25	311·5	4·75	7·5...11·2		

A and C.

1880·236	83°·6	47″·11	...9·5	10 : 20	II.
1880·274	82·8	47·54	...9·5	10 : 15	II.
1880·277	82·9	47·26	...9·0	—	II.
1880·26	8·31	47·30	.. 9·3		

β 912. W. x. 253.

R.A. 10h 16m 26s
Decl. − 13° 4′

1879·134	104°·8	0″·95	8·5...12·0	10 : 20	III.
1879·206	107·8	0·95	8·7...11·8	10 : 35	III.
1879·17	106·3	0·95	8·6...11·9		

β 913. 40 *Leo Minoris.*

R.A. 10h 36m 27s
Decl. + 26° 57′

This naked-eye star has a very minute companion.

1880·266	121°·6	10″·70	6·0...13·0	11 : 00	II.
1880·274	122·7	10·82	5·5...13·0	10 : 50	II.
1880·296	124·1	11·29	—	—	II.
1880·299	123·3	11·20	6·0...13.0	10 : 00	II.
1880·373	122·2	10·68	6·0...12·5	12 : 45	II.
1880·30	122·8	10·92	6·0...13·0		

β 914. L. 20750.

R.A. 10h 39m 46s
Decl. − 10° 13′

Very unequal and difficult pair.

1880·236	338°·3	1″·53	6·5...10·8	11 : 10	II.
1880·301	339·0	1·07	7·0...12·0	9 : 45	III.
1880·27	338·6	1·30	6·8...11·4		

β 915. D.M. (25°) 2303.

R.A. 10h 43m 13s
Decl. + 24° 55′

Pair of small stars near Σ 1478.

1880·370	231°·4	1″·28	9·0...9·3	13 : 05	II.
1880·373	231·4	1·08	9·0...9·2	12 : 15	III.
1880·37	232·9	1·18	9·0...9·2		

β 916. *Crateris* 31.

R.A. 11h 8m 13s
Decl. − 14° 47′

No measures were made of this close pair.

1879·134	360°·0 ±	0″·7 ±	7·5

β 917. L. 22179.

R.A. 11h 37m 25s
Decl. + 11° 22′

1880·296	173°·8	3″·60	8·0...10·0	—	II.
1880·299	176·0	3·70	7·8...10·0		
1880·315	175·7	3·76	8·0...10·8	11 : 15	II.
1880·329	175·5	3·74	8·2...10·8	12 : 00	II.
1880·31	175·2	3·70	8·0...10·4		

β 918. L. 22496.

R.A. 11h 50m 36s
Decl. + 32° 52′

A very unequal pair, 6·7 mag. in Heis and Arg. Three faint nebulæ in a low-power field *p*.

1880·370	230°·8	7″·64	7·0...13·0	13 : 50	II.
1880·373	231·8	7·15	6·7...13·0	13 : 15	I.
1880·37	231·3	7·45	6·8...13·0		

β 919. W. xi. 1013.

R.A. 11h 52m 7s
Decl. + 33° 49′

A naked-eye star, 6·7 mag. in Heis and 6·0 in Arg.

1880·370	13°·8	4″·33	6·0...12·3	13 : 15	II.
1880·373	17·5	4·12	6·5...12·0	13 : 00	II.
1880·375	17·3	4·22	6·5...12·5	12 : 50	II.
1880·37	16·2	4·22	6·3...12·3		

β 920. *Corvus* 17.

R.A. 12h 9m 34s
Decl. − 22° 41′

Atmospheric conditions unfavourable. This is L. 22971.

1879·373	232°·4	0″·77	6·5...7·0	12 : 25	II.

β 921. *Corvus* 22.

R.A. 12h 11m 42s
Decl. − 23° 21′

1879·373	217°·9	2″·92	7·0...10·8	12 : 15	II.
1879·375	220·0	3·05	7·5...12·0	12 : 45	II.

This star is L. 23027. It was measured at Madison in 1881 on three nights, the mean of the five measures being:

1880·55	218°·5	3″·10	7·5...11·6	β	5 nights.

β 922. L. 23254.

R.A. 12h 19m 58s
Decl. − 3° 49′

This close pair was not measured.

1880·222	160°·0 ±	0″·5 ±	8·0...8·5		

β 923. *Virginis* 168.

R.A. 12h 22m 11s
Decl. + 5° 4′

A difficult pair, 7·3 mag. in Arg. Not in Lalande.

1879·331	56°·5	2″·32	6·5...13·5	12 : 20	II.
1879·342	61·7	2·03	6·8...13.14	11 : 50	II.
1879·370	60·6	2·12	7·0...13·5	12 : 20	III.
1879·33	59·6	2·16	6·8...13·5		

β 924. d′, 31 *Virginis*.

R.A. 12h 35m 53s
Decl. + 7° 28′

1879·331	26°·9	3″·80	5·8...11·5	12 : 45	II.
1879·337	31·1	3·52	5·5...11·8	12 : 10	II.
1879·342	28·0	3·35	6·0...12·0	11 : 00	II.
1879·34	28·7	3·56	5·8...11·8		

β 925. R. 2937.

R.A. 12h 51m 6s
Decl. + 44° 12′

Heis gives this as a naked-eye star, 6·7 mag.

1879·263	210°·4	7″·05	6·5...12·0	9 : 40	II.
1880·373	212·2	7·17	6·5...12·0	15 : 10	II.
1879·82	211·3	7·11	6·5...12·0		

β 926. L. 24147.

R.A. 12h 52m 13s
Decl. − 5° 24′

The magnitude is 9½ in L. and 9 in Schj.

1880·296	268°·7	1″·97	7·8...10·8	—	II.
1880·299	270·6	—	clouded.		
1880·315	271·3	2·13	8·2...11·0	11 : 30	II.
1880·395	270·8	2·08	8·5...12·0	12 : 30	II.
1880·33	270·4	2·06	8·1...11·3		

β 927. L. 24257.

R.A. 12h 56m 34s
Decl. − 5° 53′

1880·296	290°·3	4″·24	8·2...10·0	—	II.
1880·315	293·7	4·12	8·3...10·5	11 : 40	
1880·331	290·0	4·16	8·3...10·5	12 : 00	II.
1880·31	291·3	4·17	8·3...10·3		

β 928. L. 24274.

R.A. 12h 57m 10s
Decl. − 5° 57′

1880·296	312°·3	1″·72	8·0,..9·0	11 : 20	II.
1880·315	314·5	1·84	7·5...8·5	11 : 45	II.
1880·331	312·8	1·93	8·0...8·5	12 : 10	II.
1880·31	313·2	1·83	7·8...8·7		

β 929. 48 *Virginis*.

R.A. 12h 57m 43s
Decl. − 3° 1′

A fine close pair, and not very difficult, as the stars are sensibly equal in magnitude.

1879·373	230°·4	0″·52	6·5...6·5	13 : 00	IV.
1879·408	228·5	0·47	—	13 : 20	V.
1879·416	229·2	0·47	6·0...6·0	13 : 10	V.
1879·40	229·4	0·48	6·2...6·2		

β 930. B.A.C. 4389.

R.A. 13h 0m 28s
Decl. + 45° 54′

This naked-eye star is a fine unequal pair.

1879·263	107°·8	3″·06	6·0...13·0	10 : 05	III.
1879·274	110·5	2·55	6·0...12·0	10 : 45	II.
1879·291	109·3	2·42	6·0...12·0	11 : 10	III.
1879·28	109·2	2·68	6·0...12·3		

β 931. *Virginis* 454.

R.A. 13h 4m 51s
Decl. + 13° 57′

Not given by HEIS as a naked-eye star. This is L. 24489.

1879·255	205°·7	4″·78	7·0...11·0	12 : 40	III.
1879·329	204·5	4·92	6·7...12·5	12 : 15	II.
1879·331	205·0	5·50	6·5...11·5	13 : 30	II.
1880·395	204·5	4·38	6·5...12·0	12 : 50	II.
1879·25	204·9	4·89	6·7...11·8		

β 932. *Virginis* 550=B.A.C. 4531.

R.A. 13h 28m 28s
Decl. − 12° 36′

This naked-eye star is catalogued as a variable on the authority of SCHMIDT, by whom its variation was discovered in 1866. The change is stated to be from 5 to 8 magnitude, but nothing appears to be known of its period. It is given 6½ mag. in LALANDE, and 6·7 in HEIS. As a variable it has been designated Z *Virginis*. It was found to be a very close pair in 1879, with a very minute distant companion. If the principal star is really variable, it will be interesting to ascertain whether both of the components change, or only one. Hitherto close double stars have not been found among variables.

A and B.

1879·370	81°·8	0″·49	6·0...6·3	13 : 15	IV.
1879·373	79·0	0·47	6·5...6·8	13 : 20	IV.
1879·408	86·9	0·49	6·0...7·0	13 : 40	IV.
1879·416	77·1	0·45	6·0...6·3	13 : 00	V.
1879·39	81·2	0·47	6·1...6·6		

AB and C.

1879·370	156°·7	23″·70	...12·0	13 : 20	IV.
1879·373	156·3	24·06	...13·0	13 : 25	IV.
1880·296	152·7	23·71	...12·3	—	II.
1879·68	155·2	23·82	...12·4		

The close pair was subsequently measured by me with the Madison 15½-inch on three nights. There is no satisfactory evidence of motion or variability. The mean result of the later measures is:

1881·37	84°·9	0″·51	6·0...6·8

β 933. AC=H. 2661.

R.A. 13h 29m 7s
Decl. + 33° 45′

The principal star of this wide pair, catalogued by HERSCHEL, is a moderately close pair. It is too easy to have escaped any prior observer with even a small refractor:

A and B.

1879·246	30°·5	2″·30	8·5...9·0	10 : 50	II.
1879·252	30·4	1·66	8·5...8·8	10 : 40	II.
1880·348	29·2	1·60	8·5...9·0	12 : 10	II.
1880·373	32·5	1·97	8·2...8·5	14 : 50	II.
1879·80	30·7	1·88	8·4...8·8		

A and C.

1879·246	21°·2	34″·42	...12·13	11 : 00	II.
1879·252	22·1	34·44	...12·13	10 : 50	II.
1880·348	22·0	34·58	...12·5	12 : 15	II.
1879·68	21·8	34·48	...12·5		

HERSCHEL gives the angle of C, 28°·0. The distance has never been measured before.

β 934. D.M. (51°) 1855.

R.A. 13ʰ 33ᵐ 0ˢ
Decl. + 51° 3′

A pair of small stars 2ᵐ 39ˢ *p.* Σ 1774 *rej.* In ARGELANDER only 9·4ᵐ.

1879·263	265°·0	1″·05	8·8.. 9·0	10 : 50	II.
1879·274	263·9	0·97	9·0...9·2	10 : 55	II.
1879·291	263·3	1·11	9·0...9·3	11 : 25	II.
1879·28	264·1	1·04	9·0...9·2		

β 935. 86 *Virginis.*

R.A. 13ʰ 39ᵐ 33ˢ
Decl. — 11° 49′

As a wide double (A and C) this was catalogued by STRUVE, and subsequently rejected (Σ 1780 *rej.*). With the 18½-inch the principal star was at once seen to be double, but this had been measured four times before the duplicity of the STRUVE companion was noticed. The latter is a very difficult pair, and will require probably at least a 12-inch to show it. Altogether this group forms apparently one of the finest quadruple systems known. There are no prior measures of the distance of AC. HERSCHEL (*Cape Obs.*) gave the angle 160°·3 (1836·4).

A and B.

1879·329	298°·1	1″·51	5·5...10·0	13 : 05	III.
1879·331	298·9	1·92	5·7...10·5	13 : 10	II.
1879·340	298·6	1·60	—	12 : 50	II.
1879·370	294·7	1·73	6·0...11·0	13 : 25	III.
1879·408	301·7	1·28	5·0...10·5	14 : 00	III.
1879·37	298·4	1·61	5·5...10·5		

C and D.

1879·373	274°·7	1″·82	11·5...12·5	—	III.
1879·408	276·3	1·56	11·5...13·0	13 : 55	III.
1879·416	272·3	1·79	11·8...13·0	13 : 45	III.
1879·40	274·2	1·72	11·6...12·8		

A and C.

1879·329	164°·0	26″·78	—	13 : 10	II.
1879·331	165·4	27·10	—	13 : 20	II.
1879·33	164·7	26·94			

β 936. D.M. (35°) 2505.

R.A. 13ʰ 51ᵐ 3ˢ
Decl. + 35° 13′

1880·373	97°·4	3″·80	8·3...12·5	14 : 30	II.
1880·375	98·3	4·09	8·5...12·0	14 : 50	II.
1880·37	97·8	3·94	8·4...12·2		

β 937. W. xiii. 1122.

R.A. 13ʰ 51ᵐ 52ˢ
Decl. + 35° 1′

A pair of small stars, 48ˢ *f.* and 12′ *s.* of the last.

1880·370	105°·6	0″·89	8·0...8·2	15 : 45	III.
1880·373	104·5	1·04	8·0...8·1	14 : 20	III.
1880·375	104·2	0·89	8·3...8·5	14 : 30	III.
1880·37	104·8	0·94	8·1...8·3		

β 938. O. Arg. 13375.

R.A. 13h 59m 29s
Decl. — 26° 0′

This pair is 3s *p.* and 6′ *n.* of *π Hydræ*.

1879·373	292°·2	0″·88	7·3...7·3	14 : 20	III.
1879·416	303·1	0·90	7·8...7·8	13 : 55	III.
1879·39	297·6	0·89	7·5...7·5		

β 939. L. 26065.

R.A. 14h 7m 48s
Decl. — 7° 58′

A and B.

1879·370	160°·5	0″·69	8·0...8·0	14 : 15	III.
1880·468	151·8	0·61	8·0...8·2	15 : 10	V.
1879·92	156·1	0·65	8·0...8·1		

AB and C.

1879·370	280°·9	87″·25	9·0...	14 : 20	III.

β 940. 52 *Hydræ*.

R.A. 14h 21m 9s
Decl. — 28° 57′

This star has a small but not very difficult companion.

1879·373	276°·3	3″·95	5·5...11·0	14 : 40	II.
1879·433	275·9	4·12	4·5...12·0	15 : 00	II.
1879·441	278·1	3·92	5·0...11·0	14 : 45	II.
1879·42	276·8	4·00	5·0...11·3		

β 941. W. xiv. 514=L. 26605.

R.A. 14h 29m 40s
Decl. + 0° 46′

The *n. p.* of two stars. Very unsteady during the second measure.

1879·331	214°·9	0″·72	8·2...8·2	12 : 20	III.
1879·433	221·7	0·87	—	15 : 35	III.
1879·28	218·3	0·80	8·2...8·2		

β 942. *Anon.*

R.A. 14h 47m 29s
Decl. + 0° 2′

A pair of small stars 187″ from OΣ (App.) 131, in the direction of 221°·5. Not in Arg. D.M.

1879·433	188°·7	1″·29	9·0...9·0	15 : 10	II.
1879·441	191·2	1·20	9·5...9·5	15 : 00	II.
1879·44	189·9	1·24	9·2...9·2		

β 943. L. 27885.

R.A. 15h 12m 16s
Decl. + 1° 23′

An unequal pair in the vicinity of 6 *Serpentis*. Not in Heis; 7m in Lalande.

1879·433	94°·9	2″·21	...12·5	15 : 50	II.
1879·441	91·2	2·43	6·8...12·5	15 : 20	II.
1879·468	90·8	2·18	6·5...13·0	15 : 00	III.
1880·465	93·3	2·37	6·5...11·0	16 : 00	II.
1879·70	92·5	2·30	6·6...12·2		

β 944. L. 28326.

R.A. 15h 25m 34s
Decl. + 48° 8′

In Lalande 6m, and Radcliffe 6·7m, but not in Heis.

1879·266	128°·5	10″·64	6·5...12·0	12 : 30	II.
1879·291	128·5	10·85	6·5...13·0	11 : 55	II.
1879·28	128·5	10·74	6·5...12·5		

β 945. L. 28358.

R.A. 15h 26m 9s
Decl. + 57° 51′

1879·263	12°·9	16″·49	6·3...12·5	11 : 50	II.
1879·274	13·6	16·54	7·0...12·5	11 : 10	II.
1879·291	12·8	16·08	7·0...13·0	12 : 05	II.
1879.28	13·1	16·37	6·8...12·7		

β 946. B.A.C. 5248.

R.A. 15h 44m 44s
Decl. + 55° 45′

A fine pair of unequal stars. In HEIS 5m.

1879·263	154°·8	1″·28	5·0...10·7	12 : 10	III.
1879·274	152·3	1·32	5·5...10·5	11 : 20	III.
1879·291	149·0	1·34	5·0...11·5	12 : 30	III.
1879·28	152·0	1·31	5·2...10·9		

β 947. β *Scorpii*.

R.A. 15h 58m 28s
Decl. − 19° 29′

This prominent star has been known as a wide pair since the earliest double star observations (=7 Ḧ III. = SH. 217 = σ506), and has been repeatedly measured by many observers. The large star is a close double, but the components are so unequal that it is a very difficult object, and will require in this latitude an object glass of not much less than 12 inches to show it well.

A and B.

1879·468	87°·0	0″·76	2...10·0	15 : 20	V.
1879·575	90·4	0·82	...10·0	—	V.
1879·581	90·9	—	... 9·5		
1880·460	90·3	1·00	...10·0	16 : 00	V.
1880·468	84·6	0·98	... 9·5	15 : 20	V.
1880·627	87·1	1·01	.. 9·0	16 : 50	V.
1880·05	88·4	0·91	... 9·7		

A and C.

1879·496	24°·4	13″·34
1879·499	24·5	13·55
1879·575	24·4	13·60
1879·52	24·4	13·50

Another set of measures of both components was subsequently made by me at Madison with the 15½-inch refractor. A mean of three measures gave for A B:

1881·50	92°·7	0″·96	...9·3

The distant star appears to have remained substantially unchanged with reference to A since the earliest observations. Some of the measures are:

1782·3	25°·1	14″·37	Ḧ	1 night
1823·28	26·5	13·65	Sh.	
1868·56	25·5	13·71	De.	4 nights
1879·55	24·3	13·82	Cin.	7 „
1880·50	25·2	13·41	β	3 „

β 948. *Libræ* 213.

R.A. 15h 59m 19s
Decl. − 5° 58′

The distant companion was catalogued by STRUVE, but rejected from the list in *Mensuræ Micrometricæ*. Both C and D were observed by HERSCHEL at the Cape of Good Hope, who found the angles 230°·5 and 185°·0 respectively. The distances were not measured. The discovery of the close star makes it an interesting object.

A and B.

1879·425	149°·0	1″·51	...9·0		
1879·433	147·4	1·54	6·5...9·5	16 : 10	III.
1879·441	154·6	1·49	7·0...9·5	15 : 45	III.
1880·468	150·9	1·32	7·0...9·5	16 : 00	V.
1879·59	150·5	1·46	6·8...9·5		

A and C (= Σ 2005 *rej.*).

1879·419	233°·6	28″·54	6·5...10·8	17 : 15	
1879·425	233·9	28·55	...10·0	10 : 00	
1879·42	233·7	28·54	...10·4		

	A and D.				
1879·419	192°·5	52″·26	...11·2	17 : 20	
1879·425	192·9	52·29	...10·5	17 : 00	
1879·42	192·7	52·27	10·8		

β 949. L. 29365.

R.A. 16h 1m 54s
Decl. − 9° 47′

1879·499	201°·4	0″·75	8·0...8·0	16 : 10	III.
1880·468	197·6	0·50	8·0...8·1	16 : 10	V.
1880·512	195·7	0·49	7·0...7·2	15 : 50	V.
1880·526	196·4	0·74	7·5...7·5	16 : 20	IV.
1880·25	197·8	0·62	7·6...7·7		

β 950. Lamont 1987.

R.A. 16h 18m 44s
Decl. − 9° 35′

1880·465	358°·9	1″·24	8·0...9·0	16 : 15	III.
1880·468	354·3	1·10	8·0...9·0	16 : 20	V.
1880·512	354·0	1·18	8·0...9·5	16 : 00	III.
1880·526	356·0	1·22	8·5...9·5	16 : 35	III.
1880·529	352·1	1·18	8·5...9·5	16 : 10	III.
1880·50	355·1	1·18	8·2...9·3		

β 951. W. xvi. 543.

R.A. 16h 18m 59s
Decl. + 33° 40′

A close pair of small stars near *ν Coronæ*.

1879·296	54°·9	0″·98	8·3...9·0	12 : 45	III.
1879·345	59·8	0·98	8·0...8·5	12 : 35	III.
1879·32	57·3	0·98	8·2...8·7		

β 952. W. xvi. 938.

R.A. 16h 31m 9s
Decl. + 37° 9′

1880·416	146°·7	3″·84	8·0...10·5	13 : 45	II.
1880·482	146·2	3·86	8·0...10·5	15 : 00	III.
1880·540	145·5	3·84	8·0...10·0	16 : 20	II.
1880·48	146·1	3·85	8·0...10·3		

β 953. O. Arg. 16454.

R.A. 16h 37m 49s
Decl. + 70° 2

A difficult pair; measured once only.

1879·274	328°·7	0″·30	7·8...8·3	16 : 35	V.

β 954. 54 *Herculis*.

R.A. 16h 50m 59s
Decl. + 18° 38′

A fine unequal pair, and not very difficult.

1879·342	172°·9	2″·25	5·0...12·5	14 : 30	III.
1879·373	175·7	2·79	5·0...12·0	16 : 35	III.
1879·378	177·5	2·65	...12·5	16 : 20	II.
1879·36	175·4	2·56	5·0...12·3		

β 955. Redhill 2542.

R.A. 16h 55m 50s
Decl. + 82° 3′

A close and difficult pair 11′ *s.* of *ε Ursæ Minoris*, and 2m 27s *p*.

1880·681	348°·0	0″·54	8·2...9·5	18 : 45	III.

β 956. O. Arg. 16420.

R.A. 17h 4m 10s
Decl. − 26° 33′

This star was suspected with the 6-inch to be double at the time of the discovery of β 125, in 1873, as stated in the note to that pair in my Third Catalogue. Since that time I have looked at it at least a score of times with several instruments, including the 18½-inch, on a number of nights, but was never able to be quite certain that this star was single, or that it

was really double. On the occasion of the first measure given below, the duplicity was obvious, although a very difficult object even with the large aperture. It is singular, to say the least, that it should have been even suspected, under any circumstances, with the small refractor. This star is almost directly preceding the well-known pair, 36 *Ophiuchi*.

1880·468	166°·3	0″·56	8·0...10·0	17 : 00	V.
1880·559	159·9	0·71	8·0...9·5	17 : 00	IV.
1880·51	163·1	0·63	8·0...9·7		

β 957. L. 31341.

R.A. 17ʰ 8ᵐ 57ˢ
Decl. − 10° 10′

1879·499	19°·7	0″·64	8·0...8·0	17 : 10	III.
1880·468	25·0	0·42	7·8...7·8	17 : 40	V.
1880·529	26·1	0·68	8·0...8·0	16 : 30	IV.
1880·16	23·6	0·58	7·9...7·9		

β 958. L. 31344.

R.A. 17ʰ 9ᵐ 25ˢ
Decl. − 19° 12′

1880·520	223°·1	1″·31	8·3...8·8	16 : 15	II.
1880·529	218·8	1·44	—	16 : 45	III.
1880·52	221·0	1·38	8·3...8·8		

β 959. *Ophiuchi* 185.

R.A. 17ʰ 16ᵐ 8ˢ
Decl. + 5° 7′

In Lalande 6½ mag.; not in Heis.

1879·433	258°·8	3″·35	7·0...12·0	17 : 10	II.
1879·460	258·0	3·41	7·5...12·5	16 : 20	II.
1879·463	260·4	2·83	7·0...12·5	17 : 15	II.
1880·526	257·6	3·37	7·2...11·5	17 : 00	II.
1880·540	258·8	3·35	7·0...11·5	17 : 10	III.
1879·88	258·7	3·26	7·1...12·0		

β 960. L. 32122.

R.A. 17ʰ 32ᵐ 2ˢ
Decl. − 1° 5′

1880·518	295°·6	2″·77	8·5...11·8	11 : 10	II.
1880·526	294·9	3·35	—	—	II.
1880·529	295·0	3·24	8·5.. 12·0	12 : 00	II.
1880·540	294·2	3·37	8·2...10·5	10 : 05	II.
1880·53	294·9	3·18	8·4...11·1		

β 961. L. 32206.

R.A. 17ʰ 33ᵐ 32ˢ
Decl. + 3° 28′

1880·597	140°·5	8″·02	7·0...11·8	17 : 25	III.
1880·600	140·5	7·96	7·0...11·5	17 : 40	II.
1880·602	141·4	8·43	7·0...10·8	17 : 30	II.
1880·60	140·8	8·14	7·0...11·4		

β 962. 26 *Draconis*.

R.A. 17ʰ 33ᵐ 44ˢ
Decl. + 61° 58′

A very fine pair, and not difficult, although the components are considerably unequal. This star has an annual proper motion, according to Argelander, of 0″·582 in the direction of 152°·2. It is evident that a brief interval between observations will be sufficient to determine whether this movement is common to both stars.

1879·274	147°·9	1″·34	5·5...10·5	13 : 50	III.
1879·291	150·3	1·38	5·5...10·5	13 : 35	III.
1880·627	154·7	1·52	5·0...10·0	21 : 00	V.
1880·678	154·4	1·62	6·0... 9·5	19 : 20	III.
1879·97	151·8	1·37	5·5...10·1		

In 1881 I made another set of measures with the 15½-inch at Madison on three nights, the mean result of which gives:

1881·53	148°·1	1″·31	5·8...10·2

There can be no doubt that this pair

constitutes a binary system. In consequence of the proper motion of 26 *Draconis*, the distance of the companion at the time of the second set of measures would have been only 0″·47, provided it did not participate in this motion.

β 963. L. 32206.

R.A. 17h 33m 59s
Decl. + 3° 28′

The magnitude in ARGELANDER is 7·2. There are two minute stars more distant in the same quadrant.

1880·526	141°·7	7″·70	6·5...12·0	17 : 25	II.
1880·529	140·7	7·94	6·8...11·5	17 : 20	II.
1880·540	142·8	7·90	6·8...11·5	16 : 40	II.
1880·578	141·5	8·06	7·0...11·5	17 : 20	II.
1880·54	141·8	7·90	6·8...11·6		

β 964. R. 3775.

R.A. 17h 47m 39s
Decl. + 48° 26′

A close, unequal, and very difficult pair.

1879·274	159°·2	0″·97	7·5...12·5	14 : 55	III.

β 965. *Anon.*

R.A. 18h 20m ±
Decl. − 17° 30′ ±

Difficult and unequal pair.

1880·597	106°·8	1″·53	8·0...12·0	18 : 15	III.
1880·600	106·1	1·74	8·0...11·5	18 : 00	III.
1880·602	104·0	1·43	8·3...12·0	17 : 50	III.
1880·60	105·6	1·57	8·1...11·8		

β 966. B.A.C. 6301.

R.A. 18h 25m 25s
Decl. − 19° 3′

A is the principal star of the large cluster, MESSIER 25, HEIS 6·7 mag., the distant companion being a close pair.

A and BC.

1880·549	252°·8	66″·03	—	17 : 35	II.
1880·592	252·6	66·61	6·8...	17 : 15	III.
1880·597	252·9	66·38	6·7...	18 : 00	IV.
1880·58	252·8	66·34	6·7...		

B and C.

1880·592	120°·0	0″·57	9·0...9·5	17 : 20	IV.
1880·597	116·8	0·67	9·0...9·5	17 : 50	IV.
1880·613	123·9	0·62	9·0...9·5	19 : 00	IV.
1880·61	120·2	0·62	9·0...9·5		

β 967. *Scutum Sob.* 47.

R.A. 18h 34m 5s
Decl. − 14° 37′

Place from LAMONT. In one observation the larger star was called reddish.

1880·526	196°·5	2″·37	8·0...11·0	18 : 10	II.
1880·529	197·6	2·31	8·0...12·0	18 : 25	II.
1880·540	193·8	2·57	7·8... 9·8	18 : 00	II.
1880·559	195·3	2·49	8·0...11·5	17 : 50	II.
1880·54	195·8	2·44	8·0...11·1		

β 968. ζ *Lyræ*.

R.A. 18h 40m 38s
Decl. + 37° 29′

A and B.

1880·430	275°·1	43″·25	4·0...13·0	16 : 00	III.
1880·573	275·7	43·50	...13·5	17 : 15	III.
1880·50	275·4	43·37			

A and C. (Σ 38 App. I.)

1880·430	149°·7	43″·54	...6·0	16 : 05	III.
1880·553	149·5	43·42	—	18 : 10	III.

A and D.

1880·430	304°·2	—	...11·0	16 : 10	III.
1880·553	304·0	61·66	...11·8	18 : 15	III.

The new star is excessively faint. The comparatively bright star was measured simply to fix its place for the identification of B. When the latter is seen, D will be a prominent object in the field. A and C are relatively fixed:

1835·23	149°·7	43″·71	Σ	5 nights.
1878·23	149·6	44·11	Je.	10 „
1880·49	149·6	43·48	β	2 „

β 969. Schj. 219.

R.A. 18ʰ 43ᵐ 49ˢ
Decl. − 8° 3′

This is No. 219 of Schjellerup's 'Catalogue of Red Stars.'

1880·529	237°·1	14″·07	7·0...12·0	18 : 40	II.
1880·540	235·8	14·45	7·0...11·0	18 : 20	II.
1880·559	236·9	14·43	7·0...12·0	18 : 00	II.
1880·578	236·7	14·38	6·8...12·5	17 : 30	II.
1880·51	236·6	14·33	7·0...11·9		

β 970. *Anon.*

R.A. 18ʰ 44ᵐ 15ˢ
Decl. − 8° 7′

Closely following the last. Not in any star catalogue I have.

1880·559	107°·0	1″·56	8·2...11·5	18 : 15	III.
1880·581	106·5	1·32	8·5...10·8	18 : 20	III.
1880·592	107·2	1·40	8·0...11·5	17 : 30	III.
1880·597	108·5	1·43	8·5...11·0	18 : 30	III.
1880·58	107·3	1·43	8·3...11·2		

β 971. *Draconis* 205.

R.A. 18ʰ 44ᵐ 24ˢ
Decl. + 49° 18′

This is a very difficult pair, the components being quite unequal. Not in Heis. L. 35119.

1879·274	353°·6	0″·59	6·5...8·5	15 : 20	IV.
1880·482	355·9	0·50	6·5...8·5	15 : 40	V.
1879·88	354·7	0·54	6·5...8·5		

β 972. Schj. 7042.

R.A. 18ʰ 49ᵐ 59ˢ
Decl. − 0° 43′

A and B.

1880·526	4°·9	1″·15	9·0... 9·5	18 : 20	III.
1880·529	2·6	0·98	8·8... 9·5	18 : 00	III.
1880·534	4·8	0·96	9·0...10·0	18 : 20	III.
1880·539	7·3	1·23	9·0... 9·7	18 : 25	IV.
1880·581	3·9	1·14	8·8... 9·5	18 : 35	III.
1880·42	4·7	1·09	8·9... 9·6		

A and C.

1880·526	14°·4	73″·54	... 9·0	18 : 25	III.
1880·529	14·4	73·57	... 9·0	18 : 05	III.
1880·534	14·4	73·48	... 9·0	18 : 25	III.
1880·539	14·5	73·73	... 9·3	18 : 30	III.
1880·42	14·4	73·58	... 9·1		

β 973. AC = Σ 2435.

R.A. 18ʰ 56ᵐ 12ˢ
Decl. + 18° 35′

This was observed by Struve as a double star only. Howe at Cincinnati discovered the duplicity of Struve's companion, and in measuring that, I found the large star was also double.

A and B.

1879·342	352°·8	0″·98	8·7...12·5	—	II.
1879·575	349·7	1·51	9·3...12·0	—	II.
1880·559	350·7	1·54	9·0...11·0	—	III.
1880·581	351·1	1·43	—	18 : 50	II.
1880·597	349·1	1·67	9·5...12·0	19 : 30	III.
1880·13	350·7	1·43	9·1...12·0		

C and D (HOWE).

1879·342	83°·7	2″·19	12·0...12·0+	—	II.
1879·575	80·6	3·00	11·0...12·0	—	II.
1880·559	262·0	2·97	11·0...11·5	—	II.
1880·581	262·1	3·45	—	18 : 55	II.
1880·597	265·2	2·87	11·5...12.0	19 : 35	II.
1880·13	262·7	2·90	11·4...12·0		

A and C. (Σ 2435.)

1880·559	20°·3	10″·99			
1880·578	20·5	10·72	—	19 : 05	II.
1880·597	21·3	10·47	—	19 : 30	III.
1880·58	20·7	10·73			

A and D.

1879·342	10°·7	10″·16			
1880·559	3·4	9·63			
1880·578	3·7	9·73	—	19 : 00	II.

For AC STRUVE gives:

1827·67	12°·3	10″·25	8·5...11·5

β 974. LAMONT 3034.

R.A. 18h 58m 53s
Decl. − 6° 21′

Close pair of very small stars. A 12 mag. companion about 25″ in the direction of 100°.

1880·597	89°·2	0″·70	9·2... 9·5	18 : 55	IV.
1880·602	85·6	0·72	10·0...10·5	19 : 05	III.
1880·613	88·7	0·74	9·0... 9·5	19 : 15	IV.
1880·60	87·8	0·72	9·4... 9·8		

β 975. L. 36263. (AC=OΣ 367.)

R.A. 19h 10m 4s
Decl. + 34° 21′

As a wide pair, this is OΣ 367. The smaller component is a close and rather difficult double. There is a faint star nearer A than this, on the *f.* side.

A and BC.

1880·589	228°·0	33″·35	7·8...9·0	17 : 25	IV.
1880·592	228·1	33·48	7·0...8·8	17 : 50	IV.
1880·59	228·0	33·42	7·4...8·9		

B and C.

1880·589	221°·1	0″·80	...9·5	17 : 25	IV.
1880·592	219·5	0·75	...9·8	17 : 50	IV.
1880·597	224·9	0·75	...9·0	19 : 45	IV.
1880·59	221·8	0·77	...9·4		

There is no evidence of change in the wide pair. DEMBOWSKI gives:

1865·90	228°·3	33″·69	6·8...9·3

β 976. *Aquilæ* 122.

R.A. 19h 26m 27s
Decl. + 9° 5′

ARGELANDER 7 mag.; 6½ LALANDE; not in HEIS. L. 36963.

1880·586	109°·1	1″·94	7·0...11·0	17 : 10	III.
1880·594	102 8	2·08	7·0...10·5	19 : 00	III.
1880·597	104·5	2·05	7·0...10·7	19 : 10	III.
1880·602	103·8	1·97	7·7...11·0	19 : 20	III.
1880·59	105·0	2·01	7·0...10·8		

β 977. L. 37329.

R.A. 19h 34m 19s
Decl. + 4° 4′

1880·689	59°·6	4″·15	8·0...12·0	18 : 55	II.
1880·695	58·4	3·80	8·3...12·0	19 : 20	II.
1880·703	58·7	3·39	8·5...13·0	19 : 20	II.
1880·70	58·9	3·78	8·3...12·3		

β 978. W. xix. 1470.

R.A. 19h 46m 22s
Decl. + 23° 13′

1880·473	234°·9	1″·07	8·0...8·2	18 : 00	III.
1880·482	233·9	0·74	8·3...8·3	16 : 55	V.
1880·485	233·8	1·02	8·5...8·6	17 : 40	III.
1880·48	234·2	0·94	8·3...8·4		

β 979. W. xix. 1496.

R.A. 19h 46m 57s
Decl. + 22° 58′

1880·482	339°·8	2″·27	8·3...10·8	17 : 00	III.
1880·485	338·0	2·29	8·0...11·0	17 : 50	II.
1880·518	338·3	2·16	8·5...11·5	18 : 45	II.
1880·49	338·7	2·24	8·3.. 11·1		

β 980. η *Cygni.*

R.A. 19h 51m 48s
Decl. + 34° 46′

The two distant companions, C and D, were noted by HERSCHEL, and constitute H. 1455. These stars are called 18 magnitude. They have each several times the light of the new companion, B.

A and B.

1879·400	211°·7	7″·54	5...12·5	17 : 45	II.
1879·458	209·2	7·35	4·5...13·5	18 : 40	II.
1879·468	206·0	6·71	...13·14	18 : 00	III.
1880·553	210·4	7·01	...13·0	18 : 30	II.
1880·562	210·6	6·74	...13·0	18 : 20	II.
1879·89	209·6	7·07	5...13		

A and C.

1879·468	325°·3	46″·17	...11·5	18 : 00	III.

A and D.

1879·468	170°·0	49″·52	...11·5	18 : 05	III.

β 981. W. xix. 1687.

R.A. 19h 52m 40s
Decl. + 20° 13′

This pair is near β 425.

A and B.

1879·548	113°·3	3″·15	8·2...12·0	17 : 30	III.
1880·473	112·9	—	8·0...11·5	17 : 10	II.
1880·482	110·9	3·00	8·0...11·2	18 : 50	II.
1880·485	108·1	3·07	8·0...11·5	18 : 00	II.
1880·551	111·9	3·05	8·0...11·0	19 : 45	
1880·31	111·4	3·07	8·0...11·4		

A and C.

1880·485	58°·8	32″·10	—	18 : 10	II.

β 982. D.M. (25°) 4146.

R.A. 20h 6m 52s
Decl. + 26° 1′

The *s. f.* star of a wide pair, and 6½′ *s.* of a 62 mag. star.

1880·473	51°·1	0″·84	9·0...10.5	20 : 10	III.
1880·482	50·9	0·91	8·7... 9·5	17 : 25	III.
1880·47	51·0	0·87	8·8...10 0		

β 983. B.A.C. 6966.

R.A. 20h 10m 11s
Decl. + 25° 14′

A fine unequal pair. HEIS and ARGELANDER give this as a 5 mag. star.

1879·545	151°·5	0″·80	6·0...10·5	19 : 20	V.
1879·548	155·6	0·79	6·0...10·0	16 : 35	V.
1880·482	157·6	0·98	6·3...10·0	18 : 00	V.
1879·86	154·9	0·86	6·1...10·2		

β 984. L. 38958.

R.A. 20h 11m 19s
Decl. + 26° 7′

1880·473	205°·1	0″·91	7·8...8·0	18 : 20	III.
1880·482	203·2	0·81	8·0...8·3	17 : 35	III.
1880·47	204·1	0·86	7·9...8·2		

β 985. W. xx. 488.

R.A. 20h 13m 11s
Decl. + 25° 16′

HERSCHEL saw the distant companion, which he called 13 mag., but failed to notice the much more difficult star B. He gives the angle of C, 358°·4, from which it would seem no material change has taken place. There is a fourth star, 13·5 mag., about 10″ from C in the direction of 90°.

A and B.

1880·482	140°·9	5″·14	7·5...14·0	17 : 40	III.
1880·733	148·1	4·98	7·8...13·0	19 : 00	II.
1880·775	148·1	4·98	7·3...13·14	20 : 00	II.
1880·66	148·7	5·03	7·5...13·5		

A and C (=H. 1499).

1880·482	355°·9	21″·37	...10·5	17 : 45	III.
1880·733	355·5	21·57	...11·0	19 : 05	II.
1880·775	356·6	21·22	... 9·5	20 : 05	II.
1880·66	356·0	21·39	...10·3		

β 986. W. xx. 491.

R.A. 20h 14m 10s
Decl. + 34° 44′

1880·473	238°·5	4″·69	8·3...11·5	19 : 20	III.
1880·482	244·0	4·43	8·0...12·0	16 : 25	III.
1880·485	241·4	4·36	8·0...11·5	18 : 25	II.
1880·553	243·8	4·24	8·0...10·7	18 : 50	II.
1880·567	242·9	4·31	8·5...11·5	18 : 00	II.
1880·51	242·1	4·41	8·1...11·4		

β 987. AC=S. 752.

R.A. 20h 24m 50s
Decl. + 19° 1′

The wide pair was measured by SOUTH. The preceding star is a difficult pair.

A and B.

1879·430	129°·2	2″·16	...11·5	20 : 00	II.
1879·548	128·4	2·36	7·3...12·0	17 : 00	III.
1880·468	130·6	2·74	7·5...11·5	20 : 00	II.
1880·556	123·4	2·21	7·3...11·5	18 : 30	II.
1880·744	126·9	2·13	6·8...11·5	20 : 45	II.
1880·15	127·7	2·32	7·2...11·5		

A and C. (=S. 752.)

1879·430	288°·2	106″·24	7·0...7·2	—	II.
1880·556	288·8	106·10	7·3...7·3	—	II.
1879·99	288·5	106·17	...7·2		

The only prior measures of AC are by SOUTH, from which relative fixity would be inferred.

1825·0	288°·6	105″·38	7...7½

β 988. D.M. (40°) 4413.

R.A. 21h 2m 29s
Decl. + 40° 52′

Found in looking up WEBB's planetary nebula in *Cygnus*, 45′ ± *s*.

A and B.

1880·573	235°·2	1″·29	9·0...11·5	17 : 35	III.
1880·589	238·0	1·20	9·0...11·8	19 : 00	III.
1880·731	241·0	1·11	8·8...11·8	19 : 20	III.
1880·63	238·1	1·20	8·9...11·7		

A and C.

1880·567	55°·7	16″·16	9·0...9·0	18 : 15	II.
1880·573	54·7	16·14	9·0...9·0	17 : 30	III.
1880·589	55·7	15·91	8·7...8·7	19 : 00	III.
1880·58	55·4	16·07	8·9...8·9		

β 989. κ *Pegasi*.

R.A. 21h 39m 12s
Decl. + 25° 6′

This has been known as a double star since HERSCHEL I. (= ♄ N. 43 = Σ 2824).

The large star is an exceedingly close pair, and probably too difficult for most of the telescopes with which the old companion has been measured.

A and B.

1880·613	141°·0	0·32	4·0...5·0	21 : 00	V.
1880·627	133·7	0·30	5·0...5·5	18 : 50	V.
1880·725	139·8	0·23	—	22 : 30	V.
1880·766	135·2	0·22	5·5...5·5	20 : 20	V.
1880·68	137·9	0·27	4·8...5·3		

AB and C.

1880·553	304°·0	11″·55	...8·8	19 : 10	II.
1880·613	302·3	11·90	...9·5	21 : 20	III.
1880·627	301·7	11·85	...9·5	19 : 00	III.
1880·695	304·6	11·75	...8·7	20 : 30	I.
1880·60	303·1	11·76	...9·1		

The change in STRUVE'S companion is probably due to the proper motion of the large star. The close pair will certainly prove to be a binary, and is of the class where rapid motion would be expected. Some of the measures of the wide pair are :—

1831·56	308°·5	11″·01	Σ	5 nights.
1864·84	303·9	11·57	De.	7 „

β 990. D.M. (62°) 2030.

R.A. 22ʰ 1ᵐ 32ˢ
Decl. + 62° 30′

This pair was found in examining Σ 2879 and the vicinity, to see if there was any other pair which could have been observed by O Σ for Σ 2879 in 1840. The position angle of the last-named pair is about 230°. The first of three measures by O Σ was entered as 128°. On the authority of two subsequent measures this was corrected to 228°. Suspecting there might be another pair near, the search, resulting in finding this pair, was made. The first measure of O Σ may belong to this star, but it is very much more difficult than Σ 2879, from the inequality of the components, while Σ 2879 is composed of two 8 mag. stars, the distance according to O Σ being 0″·78. This question would be more easily decided if the observing book of 1840 has any estimate of magnitudes. The magnitude in ARGELANDER of D.M. (62°) 2030 is only 9·0.

1880·573	124°·4	0″·59	8·3... 9·4	19 : 00	V.
1880·581	119·4	0·64	8·0...10·3	20 : 35	V.
1880·681	123·0	0·72	8·5... 9·5	20 : 15	III.
1880·61	122·3	0·65	8·3... 9·7		

β 991. R. 5619.

R.A. 22ʰ 9ᵐ 1ˢ
Decl. + 51° 58′

A close and nearly equal pair.

1879·534	150°·4	0″·55	8·0...8·0	20 : 00	III.
1879·548	153·2	0·62	8·5...8·5	19 : 20	IV.
1880·562	154·6	0·63	8·0...8·0	18 : 50	IV.
1880·573	147·9	0·59	8·0 ..8·1	19 : 50	V.
1880·589	148·4	0·56	8·4...8·4	19 : 10	V.
1880·16	150·9	0·59	8·0...80		

β 992. O. ARG. 25354.

R.A. 23ʰ 10ᵐ 48ˢ
Decl. + 63° 29′

A very close and rather difficult pair.

1880·562	174°·2	0″·32	8·0...8·5	19 : 10	V.
1880·573	170·5	0·43	8·0...8·3	18 : 00	V.
1880·581	166·9	0·48	8·0...8·5	20 : 00	V.
1880·592	168·4	0·44	7·7...7·7	18 : 50	V.
1880·627	172·5	0·36	8·0...8·0	20 : 00	V.
1880·59	170·5	0·41	8·0...8·2		

β 993. *Cephei* 301.

R.A. 23h 36m 41s
Decl. + 63° 51′

Unequal pair; 6·0 mag. in Argelander, but not in Heis.

1880·678	279°·4	2″·84	7·0...11·5	—	II.
1880·709	278·9	2·79	6·8...11·0	21 : 55	II.
1880·802	278·3	2·49	7·0...11·0	21 : 35	II.
1880·813	282·0	2·58	7·4...12·0	21 : 50	III.
1880·75	279·7	2·67	7·0...11·4		

β 994. L. 46490.

R.A. 23h 37m 30s
Decl. + 24° 26′

1880·597	307°·7	1″·38	7·8...10·8	20 : 45	III.
1880·613	305·6	1·46	8·0...10·8	21 : 35	III.
1880·627	307·5	1·39	8·0...11·5	19 : 15	III.
1880·689	305·3	1·29	—	20 : 10	II.
1880·63	306·5	1·38	7·9...11·0		

β 995. R. 6180.

R.A. 23h 41m 35s
Decl. + 46° 10′

A very fine pair of close and somewhat unequal stars. In Heis, 6·7 mag.

1879·458	244°·2	0″·88	6·5...8·5	20 : 40	III.
1880·573	246·7	0·87	6·5...8·5	20 : 10	V.
1880·01	245·4	0·88	6·5...8·5		

β 996. R. 6203.

R.A. 23h 46m 31s
Decl. + 74° 53′

This is a naked-eye star, Heis, 6·7 mag. According to Argelander it has a proper motion of 0″·298 in the direction of 88°·3. A short interval will be sufficient to show whether this movement is common to both stars.

1880·592	63°·5	5″·51	6·5...12·0	19 : 30	III.
1880·627	66·2	5·54	6·8...12·0	21 : 30	III.
1880·678	65·9	5·31	7·0...11·0	22 : 30	I.
1880·681	63·4	5·74	7·0...12·0	20 : 00	II.
1880·64	64·7	5·52	6·8...11·7		

β 997. L. 47215.

R.A. 23h 58m 46s
Decl. + 45° 1′

A very easy pair near O Σ 547.

1880·711	337°·8	4″·05	8·0...9·0	21 : 05	III.
1880·722	340·5	3·88	8·0...8·7	20 : 10	II.
1880·728	340·0	4·13	7·7...9·0	20 : 40	II.
1880·775	340·4	4·01	7·8...9·0	21 : 30	II.
1880·734	339·7	4·02	7·9...8·9		

Sixteen New Double Stars discovered at Mount Hamilton, California, November 1 *to* 13, 1881, *with the* 12*-inch Refractor of the Lick Observatory.*

β 998. L. 130.

R.A. $0^h\ 7^m\ 30^s$
Decl. $+\ 5°\ 55'$

1881·854	115°·0	1″·07	8·7...8·7	22 : 35	II.
1881·859	114·1	1·03	8·5...8·5	0 : 25	III.
1881·865	115·6	1·03	8·8...8·8	0 : 05	IV.
1881·86	114·9	1·04	8·7...8·7		

β 999. ω *Andromedæ*.

R.A. $1^h\ 20^m\ 27^s$
Decl. $+\ 44°\ 47'$

A and B.

1881·835	91°·6	2″·42	...12	21 : 50	V.
1881·838	90·1	2·31	...12	21 : 00	V.
1881·840	92·4	2·28	—	22 : 05	V.
1881·859	93·6	2·17	—	21 : 30	III.
1881·84	91·9	2·29	...12		

A and C.

1881·835	110°·3	134″·27	...10·8	21 : 20	II.
1881·838	110·3	134·25	—	21 : 20	V.
1881·84	110·3	134·26	...10·8		

C and D.

1881·835	144°·4	5″·04	10·8...10·8	21 : 30	III.
1881·838	136·6	5·12	10·5...10·5	21 : 10	III.
1881·840	139.4	4·97	—	21 : 40	III.
1881·84	140·1	5·04	10·7...10·7		

The distant double companion was noted with the 6-inch (β 82), but the close companion is difficult to see and measure except in a very steady air.

β 1000. O. Arg. 935.

R.A. $1^h\ 29^m\ 27^s$
Decl. $-\ 30°\ 32'$

1881·835	337°·5	1″·67	8.0...12·0	0 : 55	III.
1881·859	335·4	1·94	7·3...12·0	0 : 30	II.
1881·84	336·4	1·80	7·6...12·0		

A very unequal pair about $1^m\ 10^s$ *p*. H. 3447.

β 1001. O. Arg. 1090.

R.A. $1^h\ 43^m\ 5^s$
Decl. $-\ 18°\ 59'$

1881·835	5°·4	1″·41	8·0...11·5	1 : 20	III.
1881·843	359·5	1·41	8·0...11·5	1 : 00	II.
1881·859	3·2	1·13	—	0 : 50	II.
1881·85	2·7	1·32	8·0...11·5		

β 1002. O. Arg. 1810.

R.A. $2^h\ 41^m\ 30^s$
Decl. $-\ 15°\ 53'$

1881·835	330°·6	1″·52	8·0...10·5	2 : 00	III.
1881·840	335·3	2·18	8·0...12·0	2 : 45	II.
1881·843	335·2	1·63	8·0...11·5	1 : 15	II.
1881·84	333·7	1·78	8·0...11·3		

Very much like the preceding pair, but a little wider.

β 1003. O. Arg. 2518.

R.A. $3^h\ 40^m\ 23^s$
Decl. $-\ 28°\ 15'$

1881·835	21°·9	2″·82	8·0...12·0	3 : 55	II.
1881·840	19·1	2·56	8·3...12·0	2 : 50	II.
1881·84	20·5	2·69	8·1...12·0		

β 1004. Lacaille 1326.

R.A. 3h 57m 26s
Decl. − 34° 49′

A and B.

1881·835	—°	1″·83	7·5...8·0	3 : 55	II.
1881·859	153·8	1·67	7·4...7·8	1 : 40	I.
1881·862	154·4	1·87	7·5...7·8	3 : 20	II.
1881·85	154·1	1·79	7·5...7·9		

A and C.

1881·859	130°·9	63″·19	...11·5	1 : 45	I.
1881·862	131·5	62·77	...11·0	3 : 25	II.
1881·86	131·2	62·98	...11·2		

β 1005. D.M. (28°) 618.

R.A. 3h 59m 20s
Decl. + 28° 37′

1881·862	64°·1	3″·41	8·5...12·0	1 : 05	II.
1881·865	61·3	3·30	8·5...11·5	0 : 30	II.

β 1006. *Anon.*

R.A. 5h 6m 17s
Decl. − 2° 21′

A and B.

1881·865	200°·3	0″·86	9·5...11·0	2 : 45	III.
1882·148	203·1	0·70	9·8...11·0	5 : 50	III.
1882·00	201·7	0·78	9·6...11·0		

A and C.

1881·865	177°·5	52″·28	... 9·5	2 : 50	III.
1882·148	178·1	52·30	...10·0	5 : 55	III.
1882·00	177·8	52·29	... 9·7		

The last measure of the components was made at the Dearborn Observatory. The close pair is rather difficult. The place is taken from the Berlin Star Catalogue. It is not found in any other star catalogue I have.

β 1007. 126 *Tauri.*

R.A. 5h 34m 22s
Decl. + 16° 28′

1881·859	265°·0	0″·28	6·0...6·5	3 : 25	VI.
1881·865	267·5	0·27	6·0...6·0	3 : 40	VI.
1881·86	266·2	0·27	6·0...6·2		

A most remarkably close and difficult pair, one of the closest known. The measured distances are decidedly too large. With a power of about 1400, the elongation was but slight. I have not been able to see it since in Chicago. Only the very best nights are suitable for such a pair.

β 1008. *η Geminorum.*

R.A. 6h 7m 38s
Decl. + 22° 32′

1881·865	300°·2	1″·10	3·0...9·0	5 : 00	V.
1882·085	301·2	0·89	—	6 : 00	V.
1882·088	302·0	0·96	...9·0	6 : 30	V.
1882·093	300·8	0·89	...8·5	4 : 15	V.
1882·096	302·8	0·98	—	3 : 20	V.
1882·05	301·4	0·96	...8·8		

A splendid unequal pair, and likely to prove an interesting system. The last four measures were made at the Dearborn Observatory. This pair and the next were found on the last night at Mount Hamilton, and hence measured there but once.

β 1009. *τ Geminorum.*

R.A. 7h 3m 30s
Decl. + 30° 26′

1881·865	175°·0	1″·76	5·0...11·0	5 : 30	V.
1882·148	181·5	1·99	...12·0	6 : 20	V.
1882·01	178·2	1·87	...11·5		

A more difficult pair than *η Geminorum*, of which only a single measure could be made in Chicago, though the star was examined many times. This and the two next preceding new pairs, 126 *Tauri* and *η Geminorum*, are good representatives of the three types of double stars which the modern refractor has revealed. No examples of either class will be found in the older double star catalogues.

β 1010. L. 44832.

R.A. 22h 49m 17s
Decl. − 6° 13′

1881·845	136°·9	1″·24	8·5...9·0	22 : 50	II.
1881·859	136·0	1·18	8·5...8·8	22 : 25	IV.
1881·85	136·5	1·21	8·5...8·9		

β 1011. Lacaille 9343.

R.A. 22h 55m 53s
Decl. − 37° 4′

1881·835	304°·2	2″·46	7·5...10·5	22 : 20	III.
1881·843	302·2	2·20	7·0...11·0	22 : 30	III.
1881·859	298·8	1·83	7·0...10·0	22 : 55	III.
1881·85	301·7	2·16	7·2...10·5		

In Yarnall 6·4 mag., and Gould 6·6 mag.

β 1012.* Lacaille 9534.

R.A. 23h 30m 45s
Decl. − 32° 32′

1881·835	250°·8	5″·62	7·5...10·5	23 : 00	II.
1881·843	251·9	5·28	7·0...10·0	23 : 00	II.
1881·854	250·1	5·10	7·0...11·0	22 : 15	I.
1881·859	251·1	5·41	—	23 : 40	II.
1881·45	251·0	5·35	7·2...10·5		

β 1013. δ *Sculptoris.*

R.A. 23h 42m 40s
Decl. − 28° 48′

A and B.

1881·859	229°·2	3″·38	5·0...13·0	0 : 05	III.
1881·865	227·2	3·34	...13·0	23 : 20	III.
1881·86	228·2	3·36	...13		

A and C (= H. 3216).

1881·859	296°·6	74″·44	...8·8	0 : 10	III.
1881·865	296·5	74·30	...9·0	23 : 30	II.
1881·914	296·8	74·08	...8·8	23 : 40	III.
1881·88	296·6	74·31	...8·9		

An excessively minute companion, and very difficult, partly, however, from its low declination. The last measure of C was made in Chicago, but the new star could not be seen with any certainty. The distance of H.'s companion has not been measured before. By a single measure he gives the angle 300°·6.

* It was not noticed until after this matter was in type that this star is identical with β775.

Micrometrical Measures of 748 Double Stars made at Chicago with the 18½-inch Refractor of the Dearborn Observatory, from November 1878 to December 1880.

No. 1. *α Andromedæ.* Σ 15, App. II.

R.A. $0^h\ 2^m\ 11^s$
Decl. $+\ 28°\ 26'$

1878·818	272°·2	70″·11	2·0...10·0		
1879·567	271·8	70·35	2·0...10·8	—	II.
1880·769	272·3	70·35	...10·5	22 : 10	II.

The change is due to proper motion. Some of the epochs are:

1836·38	266°·8	64″·96	2·0...11·2	Σ	6 nights.
1866·68	270·7	69·20	1·5...10·7	De.	3 „
1879·72	272·1	70·27	2·0...10·4	β	3 „

No. 2. *Cephei* 316. Σ 2.

R.A. $0^h\ 2^m\ 36^s$
Decl. $+\ 79°\ 3'$

1880·573. Round.
1880·592. Certainly single. First-class conditions.

A binary system in rapid motion, and now single, or beyond the reach of this instrument.

No. 3. *β Cassiopeæ.*

R.A. $0^h\ 2^m\ 45^s$
Decl. $+\ 58°\ 29'$

1879·471	324°·5	286″·0	Single distance.	II.
1879·545	324·6	287·87		

A distant star mentioned in SMYTH'S 'Cycle of Celestial Objects.' There are about a dozen stars nearer the principal star than this. SMYTH gives:

1838·65	339°·6	201″·0

No. 4. *Anon.*

R.A. $0^h\ 3^m\ 45^s$
Decl. $+\ 25°\ 14'$

1879·573	142°·9	63″·53	9·0...10·0	21 : 35	II.

From SMYTH'S 'Cycle.' There is a small star about 12″ from B, in the direction of 103°.

No. 5. 34 *Piscium.* Σ 5.

R.A. $0^h\ 3^m\ 51^s$
Decl. $+\ 10°\ 29'$

1880·592	159°·9	7″·80	5·5...10·8	21 : 50	III.
1880·760	161·2	7·83	6·5...10·8	23 : 05	II.
1880·867	159·8	7·89	5·0...10·3	23 : 00	II.
1880·890	159·2	7·76	...11·0	21 : 50	II.

There appears to be no sensible change:

1830·32	162°·7	8″·03	6·0...10·5	Σ	4 nights.
1880·78	160·0	7·82	5·7...10·7	β	4 „

No. 5*a*. β 255.

R.A. $0^h\ 5^m\ 38^s$
Decl. $+\ 27°\ 45'$

1880·573	106°·7	0″·49	7·5...8·5	22 : 10	V.

The only other measures are:

1875·76	99°·0	0″·38	De.	4 nights.

No. 6. *γ Pegasi.* (Cycle.)

R.A. $0^h\ 7^m\ 3^s$
Decl. $+\ 14°\ 31'$

A and B.

1879·468	285°·7	161″·35	...10·5	—	III.
1879·545	285·5	162·29	...11·0	21 : 00	III.
1879·51	285·6	161·82	...10·7		

A and C.

1879·468	199°·3	21″·0	...11·5	Single distance.	

No. 7. *O Σ 2.*

R.A. $0^h\ 7^m\ 11^s$
Decl. $+\ 26°\ 19'$

A and B.

1880·573	40°·0	0″·67	7·0... 8·5	22 : 20	V.
1880·666	41·5	0·61	6·8... 7·3	21 : 45	III.
1880·731	45·3	0·67	7·0... 8·5	21 : 30	IV.

A and C.

1880·573	224°·7	17″·61	... 9·3	22 : 25	V.
1880·666	225·3	17·47	... 9·5	21 : 50	II.
1880·731	225·0	17·43	...10·8	21 : 35	IV.

The close pair is a binary system in slow motion. Some of the measures are:

1851·42	59°·9	0″·80	6·9...8·3	O Σ	5 nights.
1866·64	47·4	0·5	6·5...8·0	De.	3 „
1866·59	42·3	0·65	6·9...8·1	β	3 „

No change in the distant companion:

1851·42	226°·2	17″·77	...9·6	O Σ	5 nights.
1866·64	225·3	17·51	...9·8	De.	3 „
1880·59	225·0	17·50	...9·9	β	3 „

No. 8. *Ceti* 33. β 486. (6·2 and 12·2.)

R.A. $0^h\ 8^m\ 19^s$
Decl. $-\ 8°\ 27'$

1878·835	6°·3	2″·50	6·0...12·5	
1878·865	4·5	2·61	6·5...12·0	— III.

The following are all the measures of this unequal pair:

1878·24	5°·0	3″·07	β	2 nights.
1878·85	5·4	2·55	β	2 „
1879·76	6·3	3·05	Cin.	2 „

No. 9. *Cephei* 318. Σ 13. (7·3 and 7·5.)

R.A. $0^h\ 9^m\ 25^s$
Decl. $+\ 76°\ 17'$

1880·592	95°·8	0·71	6·6...6·8	19 : 25	V.
1880·627	96·3	0·59	7·8...8·0	21 : 45	V.
1880·675	97·2	0·95	7·5...7·8	21 : 10	III.

An interesting binary system; very carefully and repeatedly observed at Pulkowa. Some of the measures are:

1848·22	116°·6	0″·57	O Σ	6 nights.
1870·16	100·1	0·52	De.	5 „
1880·63	96·4	0·75	β	3 „

No. 10. Σ 14. (8·6 and 10·5.)

R.A. $0^h\ 9^m\ 42^s$
Decl. $-\ 12°\ 39'$

1878·829	237°·6	14″·51	9·0...11·0		
1878·835	236·5	14·74	8·5...11·0		
1880·722	236·4	14·20	8·4... 9·5	23 : 10	II.

The distance seems to be decreasing:

1830·89	235°·6	15″·19	Σ	3 nights.
1864·89	236·4	14·27	De.	2 „
1878·86	236·6	14·44	β	5 „

No. 11. H. 1947. (7·5 and 10·5.)

R.A. $0^h\ 10^m\ 3^s$
Decl. $+\ 42°\ 56'$

1880·731	76°·2	9″·05	7·5...10·5	20 : 20	II.

Herschel gives the angle 81°·3, but no measure of distance.

No. 12. *O Σ* 4. (7·5 and 8·2.)

R.A. $0^h\ 10^m\ 26^s$
Decl. $+\ 35°\ 49'$

1878·906	162°·7	0″·44	7·5...8·5	22 : 00	IV.
1880·573	163·0	0·44	7·5...8·0	21 : 30	V.

Probably a binary; retrograde motion. In the mean result another measure previously made is combined with these two:

1854·01	187°·6	0″·55	O Σ	4 nights.
1873·27	173·0	0·35	De.	
1879·38	160·3	0·48	*β*	3 „

No. 13. *Σ* 19. (7·3 and 9.0.)

R.A. $0^h\ 10^m\ 27^s$
Decl. $+\ 35°\ 58'$

1878·906	132·8	2″·47	7·0...9·0	21 : 45	III.
1880·744	133·4	2·45	7·6...9·0	21 : 10	III.

The measures of this pair are not very accordant for so easy a star. Probably fixed.

1836·97	133°·1	2″·33	Σ	3 nights.
1846·65	137·7	2·19	O Σ	4 „
1857·94	138·1	2·19	Se.	2 „
1875·98	127·0	2·54	Ill.	2 „
1879·82	133·1	2·46	*β*	2 „

No. 14. B.A.C. 46. *β* 392.

R.A. $0^h\ 10^m\ 31^s$
Decl. $+\ 60°\ 52'$

1880·739	67°·8	19″·33	6·0...12·5	21 : 20	II.

No. 15. 26 *Andromedæ*. *O Σ* 5. (6·6 and 11.)

R.A. $0^h\ 12^m\ 22^s$
Decl. $+\ 43°\ 7'$

1878·840	239°·7	5·96	7·0...11·0		
1880·703	241·4	6·35	6·2...11·0	20 : 40	II.

Very little, if any, change.

1866·13	240°·2	5″·99	De.	3 nights.
1879·77	240·5	6·15	*β*	2 „

No. 16. S. 384. (7·8 and 9·2.)

R.A. $0^h\ 13^m\ 44^s$
Decl. $+\ 37°\ 34'$

1878·840	17°·2	61′·53	8·0...10·0		
1880·703	17·6	62·19	7·7... 8·7	20 : 50	II.
1880·731	17·3	62·10	7·8... 9·0	20 : 30	II.

Rectilinear motion:

1783·04	—°	30″·45	♅	1 night.
1851·99	15·4	53·35	O Σ	
1880·09	17·4	61·94	*β*	3 nights.

No. 17. *ι Ceti*. H. 1953. (4 and 11·5.)

R.A. $0^h\ 13^m\ 19^s$
Decl. $-\ 9°\ 30'$

1879·873	15°·2	62′·02	...11·0	23 : 00	II.
1880·760	15·9	61·90	...12·0	23 : 30	II.
1880·31	15·5	61·96	...11·5		

No. 18. A.C. 1.

R.A. $0^h\ 14^m\ 35^s$
Decl. $+\ 32°\ 19'$

1880·046	282°·8	0″·64	7·0...8·0	0 : 10	IV

The only prior measures of this close pair discovered by Alvan Clark are:

1859·70	277°·7	0″·4 ±	Da.	1 night.
1872·84	280·5	0·50	De.	3 nights.

No. 19. *O Σ* 6. (8·0, 9·0 and 9·2.)

R.A. $0^h\ 14^m\ 43^s$
Decl. $+\ 66°\ 20'$

A and B.

1880·627	138°·8	0″·46	8·0...9·0	21 : 50	V

A and C.

1879·564	112°·1	13″·26	...9·3	18 : 20	II
1880·627	115·3	13·57	...9·2	22 : 00	V.

The wide pair is Σ 26 *rej.* This is unchanged, but there may be slow retrograde motion in the close pair.

1849·64	144°·0	0″·77	O Σ	4 nights.
1867 67	140·6	0·6	De.	3 „

No. 20. *O Σ* 7.

R.A. $0^h\ 15^m\ 4^s$
Decl. $+\ 65°\ 48'$

A and B.

1880·581	108°·2	0″·80	8·5...9·0	21 : 10	IV.
1880·627	107·0	0·51	8·5...9.2	22 : 10	V.

A and C.

1880·627	257°·3	51″·46	...8·3	22 : 15	V.

A and D.

1880·627	103°·0	105″·15	...8·0	22 : 20	V.

There is but little, if any, change in the close pair. The angle of AC in O Σ is 180° in error. There are no prior measures of the distant star C.

1847·32	107°·2	0″·46	O Σ	2 nights	AB.
1880·60	107·6	0·65	β	2 „	
1847·32	76·3	52·44	O Σ	2 „	AC.

As Dembowski found the close pair non-measurable with his telescope in 1865, the distance may have increased slightly.

No. 21. Σ 28.

R.A. $0^h\ 17^m\ 36^s$
Decl. $+\ 28°\ 50'$

1880·731	222°·8	33″·00	8·3...8·3	20 : 50	II.
1880·769	223·2	33·08	7·8...8·0	22 : 20	II.

No recent measures of this pair. The components are evidently fixed.

1832·43	223°·1	32″·89	Σ	4 nights.
1880·75	223·0	33·04	β	2 „

No. 22. 44 *Piscium.* *O Σ* 8 *rej.*

R.A. $0^h\ 19^m\ 15^s$
Decl. $+\ 1°\ 17'$

1878·854. Certainly single with all powers.

Thought by O Σ to be a close double, but rejected in 1850 as not double. Always single in 1865 to De., and Se. in 1858. Madler has a measure in 1840 purporting to be of this star, 135°·2 : 1″·00. It is certain that this measure is erroneous or belongs to some other pair. There is no probability of this star being really double.

No. 22*a*. β 489.

R.A. $0^h\ 19^m\ 40^s$
Decl. $+\ 43°\ 31'$

1878·840 181°·1 3″·21 8·5...12·13.

The measures of this pair are:

1878·43	182°·5	3″·32	β	3 nights.

No. 23. Σ 30. (7·0 and 7·5.)

R.A. $0^h\ 20^m\ 43^s$
Decl. $+\ 49°\ 19'$

1880·703	299°·9	19″·12	7·0...8·3	21 : 05	II.
1880·709	299·6	18·87	7·0...8·7	20 : 00	II.

The motion is rectilinear.

1831·20	295°·9	21″·23	Σ	3 nights.
1863·74	298·1	19·80	De.	2 „
1880·71	299·7	19·00	β	2 „

No. 24. *O Σ* 10 *rej.*

R.A. 0h 21m 16s
Decl. + 15° 22′

1878·854. Round with highest powers.

The smaller star of the wide pair at first supposed by O Σ to be a close double, but subsequently rejected in Catalogue of 1850. MADLER has a measure of it in 1844, distance 0″·25, but marked as uncertain. DE. always found it single. It is safe to assume that it is not a double star.

No. 25. Σ 31.

R.A. 0h 21m 30s
Decl. + 40° 45′

1880·046	58°·1	6″·06	9.0...9·0	2 : 10	III.

No change since STRUVE.

No. 26. H. 1968.

R.A. 0h 21m 33s
Decl. − 17° 4′

1878·829	72°·6	7″·12	clouded.	Single distance.	
1880·722	74·6	6·69	7·3... 9·5	23 : 30	II.
1880·725	73·6	7·02	7·5...10·5	23 : 00	III.

A much finer pair than is generally found in the Catalogues of H. II. ARGELANDER gives the proper motion of the principal star 0″·356 in the direction of 92°·6. The distance of the companion is rapidly diminishing, and in a few years it promises to be a close and difficult pair. The following are all the measures:

1830· ±	61°·3	20″· ±	H.	1 night.
1877·22	73·1	8·50	De.	4 nights.
1879·87	71·9	7·46	Cin.	2 „
1880·09	73·6	6·94	β	3 „

No. 27. 12 *Ceti.* H. 322.

R.A. 0h 23m 55s
Decl. − 4° 37′

A and B.

1879·873	186°·0	8″·63	...10·5	22 : 50	II.
1879·893	187.2	8·76	—	22 : 50	II.
1880·917	187·9	8·57	6·0...11·0	23 : 35	II.

A and C.

1879·873	110°·4	211″·84	...10·0	22 : 45	II.
1879·893	110·4	212·98	—	22 : 55	II.
1879·88	110·3	212·41			

A fine pair of which there are no early measures for comparison. Probably unchanged. The distant star is given in SMYTH'S cycle: 113°·4 : 201″·0 (1837·89).

1866·76	185°·2	8″·66	De.	3 nights.
1880·23	187·0	8·63	β	3 „

No. 27*a*. Σ 33.

R.A. 0h 24m 36s
Decl. + 33° 26′

1880·711	205°·5	2″·36	8·0...8·5	20 : 50	III.

Probably fixed.

No. 28. λ *Cassiopeæ.* *O Σ* 12.

R.A. 0h 25m 9s
Decl. + 53° 50′

1880·589	144°·3	0″·51	—	20 : 45	IV.
1880·592	144·9	0·44	—	20 : 00	V.
1880·59	144·6	0·47			

The distance of this well-known binary

has remained substantially the same since 1845, the angular motion during the interval being about 22°.

No. 29. *OΣ* 13. (8·0, 11·2, 12·5 and 10·2.)

R.A. $0^h\ 25^m\ 26^s$
Decl. $+\ 36°\ 18'$

A and B.

1878·840	130°·8	6″·49	8·0...11·0		
1878·906	132·4	6·23	8·0...11·5	22 : 15	III.

A and C.

1878·840	162°·9	29″·04	...12·0		
1878·906	163·1	29·08	...12·13	22 : 20	III.
1878·87	163·0	29·06	12·5		

A and D.

1878·840	179°·8	41″·06	...10·0		
1878·906	180·3	41·44	...10·5	22 : 25	III.

The faint star C is new. The other companions appear to be fixed.

1850·06	133°·2	6″·20	0 Σ	4 nights.	AB.
1866·63	131·1	6·39	De.	3 „	
1878·87	131·6	6·36	β	2 „	
1866·20	180·9	41·22	De.	2 „	AD.
1878·87	180·0	41·25	β	2 „	

No. 30. 51 *Piscium.* Σ 36.

R.A. $0^h\ 26^m\ 12^s$
Decl. $+\ 6°\ 18'$

1880·581	82°·3	27″·50	5·5...8·3	22 : 30	IV.
1880·589	82·2	27·60	—	—	III.
1880·760	82·1	27·26	—	23 : 50	II.

The components are relatively fixed.

1833·20	82°·3	27″·42	Σ	3 nights.
1880·64	82·2	27·45	β	3 „

No. 31. 52 *Piscium.* H. 1982.

R.A. $0^h\ 26^m\ 18^s$
Decl. $+\ 19°\ 38'$

There are no prior measures of the distance of this pair except SMYTH'S, who gives 311°·0 : 25″·0 (1836·92). H. gives for the angle 309°·6.

1879·545	306°·2	38″·38	5·5...11·3	21 : 15	III.
1879·573	305·8	38·14	...11·5	22 : 05	II.
1880·760	305·2	38·37	6·0...11·5	0 : 00	II.
1879·99	305·7	38·30	5·8...11·4		

No. 32. H. 1033.

R.A. $0^h\ 26^m\ 38^s$
Decl. $+\ 62°\ 37'$

No prior measures except the angle, 220°·7, by H. and the observations of SMYTH.

1880·589	223°·2	6″·84	10...10	19 : 30	II.

No. 33. *OΣ* 15.

R.A. $0^h\ 29^m\ 14^s$
Decl. $+\ 48°\ 22'$

1879·545 Single.

This star is probably not double.

No. 34. π *Andromedæ.* H V. 17 = Sh. 4.

R.A. $0^h\ 30^m\ 28^s$
Decl. $+\ 33°\ 4'$

A and B.

1878·747	172°·8	35″·12	...9·0		
1880·703	173·2	35·96	5·0...8·5	21 : 25	II.

A and C.

1878·747	358°·0	55″·09	...11·5		
1880·703	356·6	54·84	...11·5	21 : 30	II.
1879·72	357·3	54·96	...11·5		

This is also H. 1030, there being an error of 5^m R.A. in H.'s place of that pair. H. mentions the third star, 14^m, but there are no other measures than those given above. The bright companion has remained unchanged.

1821·88	175°·4	35″·95	Sh	
1874·91	173·3	36·31	De	3 nights.
1879·72	173·0	35·54	β	2 „

No. 35. δ *Andromedæ.*

R.A. $0^h\ 32^m\ 54^s$
Decl. + 30° 12′

A and C.

1879·468	194°·4	228″·63	...10·0	19·50	II.
1879·545	194·4	229·13	...10·0	22·10	II.
1879·50	194·4	228·88	...10·0		

This very distant star was observed by Smyth, the distance being given as 122″·0 (1833·54), and angle 208°·3. There is a much nearer companion, $12{\cdot}5^m$, discovered by me with the Washington 26-inch (=β 491), the only measures of which are as follows:

1878·40	299°·3	27″·86	β	3 nights.

No. 36. B.A.C. 165. *O Σ* 16. (6·0 and 11·5.)

R.A. $0^h\ 32^m\ 22^s$
Decl. + 48° 42′

1879·545	23°·0	13″·92	6·0...11·5	20 : 20	IV.
1880·636	23·1	13·62	6·0...11·5	20 : 00	II.
1880·711	22·5	14·28	6·0...11·8	21 : 50	II.
1880·722	23·9	14.07	6·0...11·0	20 : 10	II.
1880·731	22·8	13·61	6·0...11·5	20 : 00	II.

The distance seems to be diminishing.

1845·92	25°·6	14″·76	O Σ	2 nights.
1867·09	25·0	14·24	De.	3 „
1880·47	23·1	13·90	β	5 „

No. 37. H. 323.

R.A. $0^h\ 34^m\ 35^s$
Decl. − 5° 1′

1879·873	289°·8	65″·12	6·0...8·5	23 : 30	II.
1879·893	290·0	65·07	—	22 : 20	II.
1880·917	290·0	64·65	6·5...9·0	23 : 45	II.
1879·88	289·9	65·10	6·2...8·7		

There are no prior measures except those of Smyth, 289°·9 : 57″·9 (1837·87).

No. 38. 55 *Piscium.* Σ 46. (6 and 8·8)

R.A. $0^h\ 33^m\ 37^s$
Decl. + 20° 47′

1880·666	192°·9	6″·47	6·0...8·5	22 : 12	II.
1880·810	193·7	6·55	6·0...9·0	22 : 25	III.
1880·890	194·8	6·55	6·0...8·8	22 : 05	II.

No material change since Struve.

1830·22	192°·7	6″·37	Σ	3 nights.
1880·79	193·8	6·52	β	3 „

No. 39. H. 1046. (9·5 and 10·5.)

R.A. $0^h\ 36^m\ 25^s$
Decl. + 61° 8′

1879·490	68°·0	16″·38	9·5...10·5	18 : 50	II.

Smyth found 70°·0 : 12″·0 (1835·68).

No. 40. *O Σ* 19. (8·0 and 11·2.)

R.A. $0^h\ 37^m\ 21^s$
Decl. + 36° 54′

1878·840	114°·5	9″·61	8·0...11·0		
1878·906	114·3	9·56	8·0...11·5	22 : 30	III.

Probably fixed.

1866·60	114°·4	9″·74	De.	3 nights.
1878·87	114·4	9·58	β	2 „

No. 41. Σ 52.

R.A. 0ʰ 37ᵐ 31ˢ
Decl. + 45° 35′

1878·840	19°·1	1″·54	7·8...8·0	—	III.

The substantial agreement of the later measures would seem to indicate that STRUVE's angle (25°·8) was too large.

1857·93	18°·5	1″·37	Se.	2 nights.
1867·20	17·8	1·23	De.	3 „

No. 42. 66 *Piscium.* Ο Σ 20.

R.A. 0ʰ 48ᵐ 15ˢ
Decl. + 18° 32′

1880·573	8°·7	0″·38	6·0...7·0	21 : 50	V.
1880·922	7·6	0·44	—	0 : 55	IV.

A fine close binary in rapid motion. The principal measures are the following:

1847·33	72°·8	0″·62	Ο Σ	4 nights.
1860·34	59·9	0·67	Ο Σ	3 „
1866·85	48·7	obl.	De.	3 „
1880·75	8·1	0·41	β	2 „

No. 43. γ *Cassiopeæ.* β 499.

R.A. 0ʰ 48ᵐ 50ˢ
Decl. + 60° 1′

1880·610	347°·5	51″·40			
1880·649	348·3	52·66	12·5	21 : 15	III.

The mean result of the above, and two measures previously published, is:

1879·68	348°·2	52″·15	2...13	β	4 nights.

The distant companion noted by SMYTH is a 9·5ᵐ star, about 432″ distant, in the direction of 327°·3. At least a dozen small stars nearer A than this, the nearest being the one measured above.

No. 44. Ο Σ 21.

R.A. 0ʰ 56ᵐ 4ˢ
Decl. + 46° 44′

1878·840	36°·6	1″·06	7·5...8·5	—	V.
1879·545	33·8	0·91	7·6...8·5	20 : 05	IV.

It is difficult to reconcile the several measures of O Σ from 1845 to 1851, which show no angular motion, with subsequent measures. I could not find any other pair in the vicinity.

1845·68	45°·1	0″·97	Ma.	2 nights.
1847·84	177·1	0·58	Ο Σ	4 „
1879·19	35·2	0·98	β	2 „

No. 45. B.A.C. 282. β 396.

R.A. 0ʰ 56ᵐ 13ˢ
Decl. + 60° 26′

1879·490	64°·9	1″·11	6·0...9·5	19 : 30	V.
1880·681	62·8	1·45	6·2...9·0	—	III.

This difficult and unequal pair, near γ *Cassiopeæ*, was discovered with the 6-inch. This was measured on two nights in 1878 with this instrument, and on three nights in 1881 with the Madison 15½-inch. The mean result is:

1880·36	66°·5	1″·18	β	7 nights.

No. 46. σ *Piscium.* S. 393.

R.A. 0ʰ 59ᵐ 35ˢ
Decl. + 31° 32′

A and B.

1878·980	293°·5	55″·79	6·0... 9·0	23 : 50	II.
1879·567	293·9	56·12	6·5...10·0	—	II.
1879·27	293·7	55·95	6·2... 9·5		

A and C.

1878·980	235°·4	138″·69	... 9·5	0 : 05	II.
1879·567	233·4	138·14	...10·3	—	II.
1879·27	234·4	138·41	... 9·9		

The distant star was noted by Smyth. ♅ in 1780 found the distance of B, 48″·13.

No. 47. *O Σ* 22.

R.A. 1ʰ 0ᵐ 44ˢ
Decl. + 10° 55′

1880·936	197°·6	8″·07	7·6... 9·5	23 : 50	II.
1880·939	196·6	8·71	7·7... 9·3	0 : 45	II.
1880·953	198·8	8·75	7·7...10·0	0 : 25	II.

The companion seems to have remained relatively fixed.

1847·48	195°·0	8″·75	O Σ	3 nights.
1866·73	196·0	8·55	De.	3 „
1880·94	197·7	8·51	*β*	3 „

No. 48. A.C. 13.

R.A. 1ʰ 1ᵐ 59ˢ
Decl. + 44° 34′

A and B.

1878·840	256°·2	0″·45	8·0...9·0	—	IV.

AB and C.

1878·840	359°·1	15″·44	...10·8	—	IV.

The wide pair is H. 2018=Σ 92 *rej.* H. gives for the angle 353°·5. The only other measure of this star is that given above. The duplicity of the larger star was discovered by Mr. Alvan Clark. The only other measure of this is:

1876·10	262°·4	0″·3 ±	8·1...8·5	De.	1 night.

No. 49. *η Ceti.*

R.A. 1ʰ 2ᵐ 33ˢ
Decl. − 10° 49′

1879·873	304°·5	224″·86	...9·0	23 : 50	II.
1879·893	304·5	225·59	...9·5	23 : 05	II.
1879·88	304·5	225·22	...9·2		

The only reason for measuring so uninteresting an object is the prior observations of Smyth, who found, 310°·7 : 239″·0 (1838·93).

No. 50. *φ Andromedæ.* *O Σ* 515.

R.A. 1ʰ 2ᵐ 32ˢ
Decl. + 46° 36′

1878·840	272°·3	0″·28	4·0...6·5	—	V.
1880·581	272·0	0·36	4·0...6·0	21 : 45	V.

A very close and difficult pair, of which there are but few measures. This is probably a binary system, but the motion is very slow. The following are all the measures:

1851·51	309°·9	0″·53	O Σ	4 nights.
1856·87	303·9	0·51	O Σ	3 „
1864·70	302·6	0·56	O Σ	2 „
1875·14	267·2	obl.	O Σ	1 night.
1879·05	272·4	0·28	*β*	3 nights.

The last mean includes the two measures given above, and one prior measure with this instrument. The distance is evidently diminishing.

No. 51. *β Andromedæ.*

R.A. 1ʰ 3ᵐ 0ˢ
Decl. + 34° 59′

A and B.

1878·818	269°·0	84″·79	2·0...12·13		
1879·556	268·7	85·06	...12·5	—	II.
1879·19	268·9	84·92	...12·5		

		A and C.			
1878·818	141°·1	90″·88	...11·5		
1879·556	140·3	90·64	...12·0	—	II.
1879·19	140·7	90·76	...11·7		
		A and D.			
1879·490	305°·0	126″·42	...10·5	20 : 50	II.
1879·556	304·4	126·22	...11·2	—	II.
1879·567	304·1	125·39	...11·0	—	II.
1879·54	304·5	126·01	...10·9		
		A and E.			
1878·818	87°·3	159″·00	...11·0		
1879·556	87·3	157·66	...11·0		
1879·19	87·3	157·66	...11·0		
		A and F.			
1878·818	207°·7	210″·	...11·0		
		A and G.			
1878·818	217°·5	225″·			
		A and H.			
1878·818	293°·6	305″·	...10·5		
1879·490	293·5	305·	...10·0	20 : 52	II.
1879·556	294·0	304·	—	—	II.
1879·29	293·7	304·7	...10·2		

These stars were measured, in the endeavour to identify the star given in SMYTH's 'Cycle,' 299°·0 : 225″·0 (1839·54). It is difficult even to identify the companion. It is probably either G or H. In the above measures single distances are given to the nearest whole second.

No. 52. Σ 95 (=H. 324).

R.A. 1ʰ 4ᵐ 23ˢ
Decl. − 5° 26′

1878·865	310°·0	13″·80	8·5...9·0	—	II.
1880·722	309·5	13·70	9·0...9·3	23 : 50	II.

Without sensible change.

1829·87	310°·9	14″·05	Σ	3 nights.
1879·79	309·7	13·75	β	2 „

No. 53. P. i. 4. H. 634.

R.A. 1ʰ 4ᵐ 36ˢ
Decl. + 8° 55′

1878·865	271°·6	35″·44	6·5...12·0	—	II.
1879·873	270·3	35·25	8·0...11·0	0 : 00	II.
1880·917	270·3	36·16	7·0...11·5	0 : 05	II.
1979·88	270·7	35·62	7·2...11·5		

SMYTH found 291°·0 : 35″·0 (1836·89). The magnitudes estimated above are very discordant, and as the prior estimates differ greatly among themselves, the principal star may be variable. HEIS gives it as a naked-eye star 6-7 magnitude; HERSCHEL, 6 mag.; B.A.C. 7½ mag.; ARGELANDER, 7·2 mag.; PIAZZI, 8 mag.; LALANDE, in one observation 6 mag., and in another 8 mag. In January 1875 I called it 8 mag.

No. 54. 35 *Ceti.* OΣ 27 *rej.*

R.A. 1ʰ 6ᵐ 26ˢ
Decl. + 1° 50′

1878·854. No signs of duplicity; good conditions.
1880·592. Single.

Rejected by OΣ in the Catalogue of 1850 as not being really double as at first suspected. SECCHI has two observations in 1858, giving for the angle 133°·1 and 129°·4, and distance 1″·26. MADLER, in 1844, gives angle as 60°, but the observation is marked uncertain. Notwithstanding these measures, the star is probably not double.

No. 55. Σ 104.

R.A. 1ʰ 10ᵐ 8ˢ
Decl. + 37° 50′

1878·742	323°·3	″			
1880·769	323·1	13·61	8·0...9·0	22 : 35	II.
1879·75	323·2	13·61	8·0...9·0		

No. 56. Σ 106. (8·7 and 8·7.)

R.A. 1h 10m 14s
Decl. − 7° 47′

1878·961	309°·3	4″·96	8·5...8·7	1 : 05	II.
1880·785	309·1	4·90	8·5...8·5	23 : 30	II.
1880·917	311·0	4·84	9·0...9·0	0 : 20	II.

Very little, if any, change since Struve.

1831·61	308°·6	4″·63	Σ	4 nights.
1880·22	309·8	4·90	β	3 „

No. 57. β 504. (7·5 and 12.)

R.A. 1h 11m 9s
Decl. + 1° 13′

1878·854	277°·4	1″·91	7·7...12·0	—	III.

The mean result of this and two prior measures with the same instrument is, 277°·3 : 1″·40 (1878·35) 3 *n*.

No. 58. *Anon.* (Smyth.)

R.A. 1h 11m 38s
Decl. + 58° 10′

1879·490	324°·5	13″·31	8·5...8·5	19 : 20	II.
1879·540	324·5	13·80	8·7...8·7	20 : 05	II.
1879·52	324·5	13·55	8·6...8·6		

The only other measures of this pair are those of Smyth.

No. 59. Σ 111.

R.A. 1h 11m 54s
Decl. − 4° 58′

1878·865	329°·7	20″·62	8·5...8·8	—	II.
1878·785	329·4	20·54	8·5...8·7	23 : 40	II.
1879·82	329·6	20·58	8·5...8·7		

No change since Struve.

No. 60. *Piscium* 235. β 4.

R.A. 1h 14m 59s
Decl. + 10° 55′

1878·854	73°·7	0″·50	7·0...8·0	—	III.
1881·835	82·2	0·52	7·6...8·5	0 : 40	V.
1881·843	71·8	0·72	8·0...9·0	23 : 10	V.
1880·84	75·9	0·58	7·5...8·5		

A difficult pair, found with the 6-inch, 1872. De. noticed only a doubtful elongation, 1875·6, in 68°. This pair may be in rapid motion. The last two measures were made at Mount Hamilton.

No. 61. Σ 125.

R.A. 1h 20m 50s
Decl. − 0° 46′

1878·867	351°·6	30″·26	8·0...9·0	—	II.
1880·766	350·5	31·43	7·8...8·7	22 : 40	II.
1880·785	351·0	31·35	7·7...9·0	23 : 50	II.
1880·917	351·8	31·55	—	0 : 30	II.
1880·931	350·5	31·59	—	0 : 30	II.

Remarkable for the large proper motion of the larger star, being 0″·516 in the direction of 138°·8.

1833·23	33°·3	16″·91	Σ	6 nights.
1843·90	19·3	19·05	0 Σ	2 „
1863·44	1·1	24·67	De.	7 „
1880·85	350·9	31·48	β	4 „

No. 62. η *Piscium*. β 506. (4 and 11).

R.A. 1h 25m 4s
Decl. + 14° 44′

1878·854	12°·1	1″·12	4·5...11·0	—	V.
1880·592	15·8	1·20	...10·5	23 : 15	V.
1880·920	14·6	1·16	—	23 : 40	IV.

A very fine pair, but very difficult. The two sets of measures do not indicate any change.

1878·73	12°·9	1″·02	β	3 nights.
1880·12	14·2	1·16	β	3 „

No. 63 *O Σ* 31.

R.A. 1h 26m 59s
Decl. + 7° 36′

1878·942	81°·1	3″·58	—	1 : 30	II.
1880·922	80·1	3·64	6·5...11·0	1 : 15	II.
1880·931	81·1	3·71	7·0...10·8	1 : 00	II.
1880·936	81·6	3·79	—	0 : 40	II.

There may be some change.

1850·02	85°·0	4″·04	*O Σ*	4 nights.
1866·71	82·7	4·10	De	3 „
1880·43	81·0	3·68	*β*	4 „

No. 64. 40 *Cassiopeæ*. H. 2054.

R.A. 1h 28m 53s
Decl. + 72° 25′

1879·326	236°·9	53″·08	6·0...11·0	12 : 45	II.
1879·490	237·2	53·49	6·0...10·8	18 : 20	II.
1879·41	237·0	53·28	6·0...10·9		

H. gave the angle as 241°·5, the distance being estimated. No other observations since except those in the Cycle: 240°·5 : 42″·0 (1834·95).

No. 65. *β* 507.

R.A. 1h 29m 16s
Decl. + 26° 10′

1880·997	155°·8	2″·25	8·0...10·8	2 : 30	II.
1881·000	156·4	1·96	8·0...11·0	0 : 30	II.
1881·00	156·1	2·10	8·0...10·9		

No. 66. 103 *Piscium*. *β* 5.

R.A. 1h 32m 47s
Decl. + 16° 1′

1880·594	295°·6	1″·28	6·7...9·0	23 : 25	V.
1880·920	297·0	1·23	7·0...9·5	23 : 50	IV.
1880·922	299·2	1·41	7·0...9·5	1 : 25	IV.

The following are all the measures:

1875·52	289°·4	1″·34	7·0...9·0	D.	4 nights.
1880·78	297·3	1·31	6·9...9·3	*β*	3 „

No. 67. Σ 143. (8·0 and 8·9.)

R.A. 1h 33m 32s
Decl. + 33° 44′

1878·906	319°·7	34″·01	8·0...9·0	22 : 45	III.
1880·046	319·7	34·56	—	2 : 45	III.
1880·769	319·8	34·68	8·0...8·7	22 : 50	II.

The change is evidently due to proper motion.

1831·76	319°·8	30″·31	Σ	2 nights.
1865·35	320·1	33·02	De	4 „
1879·91	319·7	34·42	*β*	3 „

No. 68. H. 2067.

R.A. 1h 33m 33s
Decl. − 18° 24′

1878·867	91°·5	23″·9	7·5...11·5	—	II

Single distance. No prior measures except angle 92°·0 of H.

No. 69. *τ Andromedæ*. *β* —.

R.A. 1h 33m 30s
Decl. + 39° 58′

1880·589	328°·3	52″·45	5·0... 9·5	21 : 00	III.
1880·775	328·5	52·25	4·0...11·0	22 : 35	II.
1880·68	328·4	52·35	4·5...10·2		

No other measures of this distant companion.

No. 70. *Anon*. (Smyth.)

R.A. 1h 34m 44s
Decl. + 50° 59′

1879·490	229°·6	33″·80	9·8...10·5	19 : 50	II.
1879·540	228·7	33·76	9·5...10·0	20 : 20	II.
1879·51	229·2	33·78	9·7...10·2		

Smyth gives 217°·0 : 45″·0 (1837·79).

No. 71. 107 *Piscium*. H. 2071.

R.A. 1h 35m 58s
Decl. + 19° 41′

A and B.

1879·873	223°·2	38″·45	...12·0	0 : 50	II.
1880·014	221·7	38·51	...12·5	—	II.
1879·94	222·5	38·48	...12·2		

A and C.

1879·873	340°·9	77″·95	...10·0	0 : 55	II.
1879·875	340·7	77·71	...10·0	23 : 30	II.
1879·87	340·8	77·83	...10·0		

The only earlier measures are in the 'Cycle' of AC 318°·3 : 55″·0 (1837·03).

No. 72. β 453.

R.A. 1h 37m 8s
Decl. + 56° 31′

1880·802	223°·7	0″·89	8·5...9·0	22 : 50	III.
1880·813	225·5	0·98	8·8...9·0	23 : 00	III.
1880·824	223·2	0·85	9·0...9·3	21 : 30	III.
1880·81	224·1	0·91	8·8...9·1		

These are the only measures of this pair.

No. 73. Σ 153.

R.A. 1h 38m 20s
Decl. + 60° 40′

1880·610	67°·8	7″·85	8·6...9·0		
1880·813	69·7	7·69	8·7...9·0	22 : 30	II.

The components appear to be fixed.

1831·77	69°·2	7″·45	Σ	3 nights.
1880·71	68·8	7·72	β	2 „

No. 74. β 736.

R.A. 1h 39m 38s
Decl. + 38° 20′

A and B.

1879·862	206°·0	0″·96	8·5...11·0	22 : 40	III.
1879·898	207·7	0·74	8·3...10·0	—	III.
1880·046	213·4	0·87	8·5...10·0	2 : 30	III.
1879·94	209·0	0·86	8·4...10·3		

AB and C (= Σ 157).

1879·854	114°·4	12″·24	9·0...9·2	21 : 45	II.
1879·898	117·2	12·56	...8·5	—	III.

The duplicity of the larger star of Σ 157 was detected with the 6-inch at Mount Hamilton. It is a very difficult object, even with a much larger aperture. The foregoing are the only measures.

There is probably no change in the distant companion.

1832·93	115°·5	12″·26	Σ	3 nights.
1879·87	115·8	12·40	β	2 „

No. 75. ε *Sculptoris*. H. 3461.

R.A. 1h 40m 1s
Decl. − 25° 39′

1879·030	61°·1	4″·28	5·0...9·0	1 : 20	II.

No. 76. Σ 160. (9·0 and 9·4.)

R.A. 1h 40m 17s
Decl. − 3° 0′

1878·865	269°·7	9″·59	9·0...9·5	—	III.
1878·980	269·1	9·57	9·0...9·3	0 : 50	II.
1880·942	270·9	9·19	9·0...9·3	0 : 30	II.

No evidence of change.

1830·66	270°·1	9″·51	Σ	5 nights.
1879·59	269·9	9·45	β	3 „

No. 77. Σ 162.

R.A. 1h 41m 48s
Decl. + 47° 18′

A and B.

1880·711	217°·4	1″·95	6·7...7·5	21 : 40	II.
1880·906	217·1	1·81	--	23 : 15	II.

A and C.

1880·711	178°·5	20″·44	...8·2	21 : 45	II.
1880·906	179·1	20·48	--	23 : 20	II.
1880·81	178·8	20·46			

There is no change in the distant star, but there appears to be a slow retrograde movement of the close pair:

1836·75	224°·5	1″·90	Σ	2 nights.
1845·99	222·6	2·02	0 Σ	3 „
1880·81	217·1	1·88	β	2 „

No. 78. H. 644.

R.A. 1h 42m 22s
Decl. + 7° 5′

1878·865	278°·8	17″·78	7·0...11·8	--	II.
1880·766	280·4	18·20	7·0...11·0	22 : 50	II.
1879·81	279·6	17·99	7·0...11·4		

No measures by H. He called the large star red. Nothing of the kind noticed in the above observations.

No. 79. β 511. (8·5, 8·5 and 12·5.)

R.A. 1h 42m 40s
Decl. − 2° 1′

B and C.

1878·865	308°·6	4″·20	8·5...13·0	—	II.
1879·030	311·5	—	8·5...13·0	1 : 40	II.
1878·94	310·1	4·20			

A and B (= Σ 171).

1878·865	159°·2	29″·70	...8·5	—	II.
1879·030	158·9	29·73	...8·5	1 : 30	II.
1880·785	160·0	29·80	...8·4	0 : 15	II.
1880·936	159·8	29·43	...8·7	1 : ∞	II.

The only prior measures of the close pair are:

1878·20	316°·0	3″·69	β	3 nights.

Relative motion in the bright stars is well shown:

1829·91	157°·6	27″·89	Σ	2 nights.
1865·12	159·0	29·12	De	4 „
1878·20	159·8	29·69	β	3 „
1879·90	159·5	29·67	β	4 „

No. 80. ζ *Ceti.*

R.A. 1h 45m 32s
Decl. − 10° 55′

1879·873	40°·8	185″·46	...9·0	0 : 30	II.
1879·893	40·6	185·88	...9·5	23 : 30	II.
1879·88	40·7	185·67	...9·2		

One of the Bedford Catalogue stars. SMYTH gives 40°·4 : 165″·0 (1835·87).

No. 81. Σ 177. (8·8 and 8·9.)

R.A. 1h 45m 13s
Decl. + 4° 21′

1878·865	121°·3	33″·43	8·5...8·5	—	II.
1878·944	121·8	33·87	9·0...9·3	1 : 10	II.
1878·980	121·5	33·51	9·0...9·0	1 : ∞	II.

The distance would seem to have diminished since STRUVE.

1829·87	121°·9	34″·27	Σ	2 nights.
1878·93	121·5	33·60	β	3 „

No. 82. 55 *Andromedæ.* H. 1094.

R.A. 1h 46m 6s
Decl. + 40° 8′

1878·906	355°·1	60″·00	5·0...12·5	23 : 00	II.
1879·540	355·4	60·27	6·0...11·5	20 : 45	II.
1879·22	355·2	60·13	5·5...12·0		

H. called this a 'fine nebulous star,' but nothing of the kind could be detected with the 18½-inch. The only prior observations are by Smyth:

1832·95	350°·0	25″·0

No. 83. *α Trianguli.*

R.A. 1h 46m 18s
Decl. + 29° 0′

A and B.

1879·592	124°·1	80″·62	...11·0	—	II.

A and C.

1879·545	182°·2	227″·90	...11·0	22 : 30	II.
1879·592	182·3	228·	Single distance.		II.
1879·862	—	229·	,,		II.
1879·67	182·2	228·30			

A and D.

1879·567	172°·8	307″·77	...10·5	—	II.
1879·592	172·8	309·	Single distance.		II.
1879·862	172·8	308·	,,		II.
1879·69	172·8	308·26			

These distant stars were measured for the purpose of identifying one of Smyth's stars, given in the 'Cycle,' 179°·0 : 110″·0 (1834·67). There is nothing in this place. There is very little doubt that Smyth's companion is the most distant star, D, measured above.

No. 84. *γ Arietis.*

R.A. 1h 46m 56s
Decl. + 18° 42′

A and C.

1878·711	84°·3	223″·82

This is a distant companion to *γ Arietis*, first measured by Sh., who gave 85°·2 : 228″·76 (1823·86). This small star was found to be a difficult double (*β* 512). There is a minute star between the two pairs.

No. 85. Σ 183. (7·9, 8·1 and 8·9.)

R.A. 1h 48m 17s
Decl. + 28° 13′

A and B.

1880·666	9°·8	0″·72	7·7...8·0	23 : 15	IV.
1880·763	9·3	0·52	8·0...8·3	22 : 30	IV.
1881·079	11·5	0·58	—	3 : 15	IV

AB and C.

1880·666	166°·3	5″·68	...9·0	23 : 20	IV.
1880·763	165·1	5·54	...8·8	22 : 35	IV.

The close pair is certainly moving slowly, but there seems to be very little change in C.

1833·12	22°·3	0″·55	Σ	3 nights.
1879·90	10·3	0·48	III	4 ,,
1880·94	10·2	0·61	*β*	3 ,,
1832·31	163°·7	5″·68	Σ	5 nights.
1880·71	165·7	5·61	*β*	2 ,,

No. 86. Σ 186.

R.A. 1h 49m 41s
Decl. + 1° 15′

1878·867	169°·0	0″·31	6·5...6·5	

A fine rapid binary. The angular motion since 1831 is over 100°.

No. 87. S. 404. (7·5 and 8·7.)

R.A. 1h 50m 49s
Decl. + 40° 48′

1878·906	73°·7	23″·14	7·5...9·0	23 : 10	II.
1880·769	73·9	23·22	7·6...8·5	23 : 05	II.

The obvious change is probably due to proper motion. The following are all the measures:

1783·60	66°·6	15″·82	H	2 nights.
1824·87	67·4	20·59	S	2 „
1879·84	73·8	23·18	β	2 „

No. 88. λ *Arietis*. H V. 12.

R.A. 1ʰ 51ᵐ 15ˢ
Decl. + 23° 1′

1880·123	45°·5	37″·52	...8·5	4 : 00	II.
1880·854	46·4	37·49	...8·0	1 : 45	II.

These stars are relatively fixed.

1821·91	45°·7	37″·89	Sh.	1 night.
1880·48	46·0	37·46	β	2 nights.

No. 89. 58 *Ceti*. β 7. (6·2 and 11·0.)

R.A. 1ʰ 51ᵐ 52ˢ
Decl. − 2° 39′

1880·939	10°·9	2″·67	6·0...11·0	1 : 00	II.
1880·942	14·7	2·79	6·5...11·0	0 : 40	II.

The following are all the measures:

1875·53	12°·1	2″·85	De.	3 nights.
1877·78	11·4	2·85	Cin.	3 „
1880·94	12·8	2·73	β	2 „

No. 90. 48 *Cassiopeæ*. β 513.

R.A. 1ʰ 52ᵐ 7ˢ
Decl. + 70° 19′

1879·490	263°·9	0″·87	5·0...8·0	18 : 05	V.

The mean of the four measures made with this telescope is, 264° 3 : 1″·00 (1878·90).

No. 91. Σ 196.

R.A. 1ʰ 52ᵐ 55ˢ
Decl. + 20° 25′

A and B.

1880·763	51°·7	2″·68	8·5...9·5	22 : 50	III.

A and C.

1880·028	165°·1	34″·24	...8·5	1 : 20	II.
1880·763	165·1	34·39	...8·8	22 : 55	III.
1880·40	165·1	34·31	...8·7		

A and D.

1880·028	2°·3	183″·86	8·0...6·0	1 : 15	II.
1880·763	2·1	184·28	...6·0	23 : 00	III.

But little change in AB, but the distance of C seems to have diminished. The distant star D was first observed by SMYTH:

1834·99	359°·2	165″·0	Sm.

No. 92. P. i. 227. (SMYTH.)

R.A. 1ʰ 53ᵐ 59ˢ
Decl. + 6° 20′

1879·873	117°·3	45″·49	8·0...8·5	1 : 10	II.
1879·893	117·2	45·44	8·5...8·7	23 : 45	II.
1879·88	117·2	45·47	8·2...8·6		

The only prior measures are in the Bedford Catalogue, 113°·9 : 43″·6 (1834·87).

No. 93. Σ 207.

R.A. 1ʰ 56ᵐ 31ˢ
Decl. + 17° 7′

1878·865	186°·4	11″·74	8·5...9·0	—	II.

No sensible change since STRUVE.

No. 94. γ *Andromedæ*. Ο Σ 38.

R.A. 1ʰ 56ᵐ 32ˢ
Decl. + 41° 45′

B and C.

1880·06c	107°·9	0″·36	7·0...8·3	3 : 35	V.

No. 95. Σ 215. (8·3 and 9·3.)

R.A. $2^h\ 1^m\ 43^s$
Decl. $+\ 40°\ 13'$

1878·900	58°·7	19″·98	8·0...9·5	23 : 05	III.
1880·769	59·6	19·73	8·5...9·5	23 : 20	II.
1880·775	59·7	20·23	8·3...9·0	22 : 45	II.

The following are all the measures:

1831·12	58°·0	19″·20	Σ	2 nights.
1885·15	59·3	19·98	β	3 „

No. 96. 14 *Arietis*. S. 406.

R.A. $2^h\ 2^m\ 35^s$
Decl. $+\ 25°\ 22'$

A and B.

1879·030	37°·0	93″·35	5·0...8·0	2 : 10	II.
1880·854	36·4	92·92	6·0...9·0	2 : 00	II.

A and C.

1879·030	278°·4	105″·51	...6·5	2 : 00	II.
1880·854	278·5	105·82	...8·0	2 : 05	II.

There is no great change in these distant stars. H's angle, 281°·2 (1783·66), evidently belongs to AC instead of AB as given. South did not measure the nearest component. The following are the principal observations:

1783·66	—°	89″·47	H	1 night.	AB.
1879·94	36·7	93·13	β	2 nights.	
1823·97	278·0	105·25	S	2 „	AC.
1874·72	278·4	106·05	De	3 „	
1879·94	278·4	105·68	β	2 „	

No. 97. Σ 229. (8·2 and 8·9.)

R.A. $2^h\ 6^m\ 50^s$
Decl. $+\ 33°\ 57'$

1878·887	356°·6	2″·45	8·5...9·0		
1880·782	358·5	2·36	8·0...8·8	22 : 55	III.

Very little change, if any.

1832·87	361°·0	2″·43	Σ	5 nights.
1879·83	357·5	2·40	β	2 „

No. 98. Σ 237. (8·5 and 8·5)

R.A. $2^h\ 9^m\ 17^s$
Decl. $+\ 10°\ 13'$

1878·865	238°·4	14″·46	8·5...8·5	—	II.
1880·854	238·6	14·43	8·5...8·5	2 : 20	II.
1880·911	238·6	14·36	8·5...8·6	2 : 05	II.

The components are relatively fixed.

1836·86	238°·4	14″·53	Σ	2 nights.
1880·21	238·5	14·42	β	3 „

No. 99. δ *Trianguli*. σ 66.

R.A. $2^h\ 9^m\ 36^s$
Decl. $+\ 33°\ 41'$

Not included in the later catalogues of Struve. I could see no companion with the 6-inch, but with the larger instrument an exceedingly faint star was detected, 13–14 mag., and estimated 360° : 30″. This is much too difficult to have been seen by the early observers.

No. 100. χ *Persei*. S. 409.

R.A. $2^h\ 9^m\ 39^s$
Decl. $+\ 56°\ 58'$

A and B.

1879·540	352°·8	70″·57	...10·5	—	II.
1879·556	352·4	70·37	...10·5	—	II.

A and C.

1879·540	136°·3	122″·66	7·0...9·0	—	II.

A and D.

1880·589	11°·1	205″·69	...10·7	20 : 10	II.

There are no prior measures of B except those of the 'Cycle,' 354°·3 : 65″·0 (1835·82). There appears to be no great change in C. S. found, 136°·5 : 124″·53 (1824·99).

No. 101. o *Ceti*.

R.A. 2h 13m 17s
Decl. − 3° 31′

A and B.

1879·939	88°·5	75″·29	...13·0	—	II.

A and C. (H vi. 1.)

1878·964	82°·3	116″·45	4·0...8·0	1 : 05	I.
1879·971	82·1	115·64	5·5...8·5	1 : 25	II.
1879·47	82·4	116·04			

The well-known variable, Mira. The faint star was found with this instrument.

No. 102. Σ 250. (8·4 and 8·7.)

R.A. 2h 13m 57s
Decl. + 36° 52′

1878·900	137°·9	3″·04	8·0...8·5	23 : 20	III.
1880·769	134·9	2·65	8·5...8·8	23 : 35	II.
1880·775	136·8	2·91	8·6...8·8	22 : 50	II.

No appreciable change in the last half-century.

1832·01	135°·8	3″·16	Σ	3 nights.
1880·15	136·5	2·87	β	3 „

No. 103. *O* Σ 40.

R.A. 2h 14m 23s
Decl. + 37° 58′

1878·909	57°·5	0″·62	8·2...8·6	0 : 25	IV.

The measures show no appreciable change.

1850·64	56°·0	0″·59	OΣ	4 nights.
1867·57	53·4	obl.	De	3 „

No. 104. P. ii. 61. σ 70.

R.A. 2h 15m 25s
Decl. + 40° 56′

1880·046	358°·1	53″·42	6·5 .. 9·5	4 : 35	II.
1880·775	359·0	53·21	6·7...11·0	23 : 15	II.
1880·41	358·5	53·31	6·6...10·0		

The only earlier measures beside those of the Bedford Catalogue are by Da. 355°·2 : 49″·0 (1842·76).

No. 105. β 8.

R.A. 2h 14m 59s
Decl. + 8° 20′

1880·920	204°·3	0″·90	8·0...9·0	0 : 30	IV.

The only other measures are:

1875·31	200°·4	0″·96	8·3...9·2	De	4 nights.

No. 106. *Ceti* 374. β 517.

R.A. 2h 18m 54s
Decl. − 4° 26′

A and B.

1878·980	247°·1	10″·81	6·5...12·5	1 : 30	II.
1878·994	248·1	10·53	6·5...12·5	1 : 45	II.
1879·002	247·0	11·19	7·0...12·5	2 : 40	III.
1878·99	247·4	10·84	6·7...12·5		

A and C.

1878·994	286°·9	54″·97	...11·5	1 : 55

No. 107. Σ 271.

R.A. 2h 23m 38s
Decl. + 24° 42′

1878·917	181°·3	12″·07	6·0...10·0	0 : 20	II.
1880·931	181·5	12·43	7·0 ..10·5	2 : 30	II

There is no change since the measures of Struve.

1831·75	180°·5	11″·86	Σ	2 nights.
1879·92	181·4	12·25	β	2 „

No. 108. β 519.

R.A. $2^h\ 23^m\ 38^s$
Decl. $-\ 2°\ 48'$

1877·942	237°·7	0″·97	8·5...10·5		
1878·854	60·0	0·63	8·0... 9·0	--	IV.
1878·40	58·8	0·80	8·2... 9·7		

The first measure is given in my previous measures. In the last observation it was expressly noted that the following star was the smallest, and there is probably an error of 180° in the first angle.

No. 109. β 304.

R.A. $2^h\ 24^m\ 5^s$
Decl. $+\ 36°\ 56'$

1878·900	282°·3	17″·70	7·5...11·5	23 : 30	III.
1880·775	283·9	18·02	7·5...11·5	23 : 30	II.
1879·83	283·1	17·86	7·5...11·5		

There are no other measures.

No. 110. Σ 274. (7·6 and 7·6.)

R.A. $2^h\ 25^m\ 20^s$
Decl. $+\ 0°\ 34'$

1878·942	40°·0	13″·39	7·5...7·5	2 : 20	II.
1880·854	39·0	13·20	7·5...7·5	2 : 30	II.
1880·911	38·8	13·18	7·8...7·8	2 : 20	II.

The components appear to be relatively fixed.

1833·37	218°·2	13″·47	Σ	3 nights.
1880·24	39·3	13·26	β	3 „

No. 111. H. 652.

R.A. $2^h\ 26^m\ 7^s$
Decl. $+\ 9°\ 3'$

1878·980	315°·2	4″·70	8·8...9·3	1 : 45	II.
1878·994	315·0	4·43	9·0...9·5	2 : 00	II.
1880·911	315·3	4·29	9·0...9·3	2 : 25	II.
1879·63	315·2	4·47	9·0...9.4		

This pair has never been measured before.

No. 112. Σ 279. (6·9 and 10·8)

R.A. $2^h\ 28^m\ 15^s$
Decl. $+\ 36°\ 47'$

1878·900	71°·6	17″·40	6·0...11·5	23 : 40	III.
1880·046	71·6	17·39	6·0...10·0	4 : 10	III.
1880·769	71·4	16·87	6·0...11·0	23 : 50	II.

There has been no change since the first measures:

1831·48	71°·2	16″·95	Σ	3 nights.
1879·90	71·5	17·22	β	3 „

No. 113. Σ 286.

R.A. $2^h\ 32^m\ 34^s$
Decl. $+\ 33°\ 26'$

1878·835	256°·6	3″·09	8·0...10·0		
1880·769	255·7	2·92	7·0... 9·5	0 : 00	II.

Probably unchanged. The only other measures since Struve are three rather discordant observations by Madler:

1830·18	251°·8	2″·71	Σ	3 nights.
1879·80	256·1	3·00	β	2 „

No. 114. 33 *Arietis*. Σ 289. (5·5 and 8·6.)

R.A. $2^h\ 33^m\ 40^s$
Decl. $+\ 26°\ 33'$

1880·123	359°·9	28″·73	...8·3	4 : 25	II.
1880·775	360·1	28·46	6·0...9·0	23 : 45	II.
1880·939	360·0	28·75	5·0...8·5	1 : 10	II.

These stars are relatively fixed.

1831·71	359°·4	28″·54	Σ	3 nights.
1880·61	360·0	28·65	β	3 „

No. 115. H. 1123.

R.A. 2h 34m 15s
Decl. + 42° 17′

1879·540	248°·5	20″·00	8·3...8·3	—	II.
1880·046	249·3	20·20	8·0...8·0	5 : 10	II.
1879·79	248·9	20·10	8·1...8·1		

The early measures by SMYTH are:

1837·78	250°·8	14″·0

No. 116. *θ Persei.* Σ 296.

R.A. 2h 35m 59s
Decl. + 48° 43′

A and B.

1879·540	298°·8	16″·48	...10·0	21 : 30	III.
1880·769	299·2	16·50	4·0... 9·0	0 : 20	II.

A and C.

1879·540	218°·5	68″·87	...10·2	21 : 20	II.
1880·769	218·3	69·60	... 9·0	0 : 25	II.
1880·15	218·4	69·24	9·6		

The only early measures of the distant star are by SMYTH, 219°·0 : 27″·0 (1833·65). There is some evidence of a physical relation between A and B.

1832·20	294°·6	15″·40	Σ	3 nights.
1853·09	296·8	16·05	0Σ	3 „
1880·15	299·0	16·49	β	2 „

No. 117. β 307.

R.A. 2h 40m 29s
Decl. + 29° 11′

1880·920	316°·0	15″·49	7·0...11·8	0 : 10	IV.

The principal star was suspected to be a close pair with the 6-inch at Mount Hamilton, but on this occasion no certain elongation could be detected.

1877·18	315°·9	15″·44	Hl	3 nights.

No. 118. Σ 310. (7·5 and 9·5.)

R.A. 2h 42m 7s
Decl. + 33° 26′

1878·838	90°·7	2″·70	7·5...10·0		
1880·063	89·7	2·47	7·5... 9·0	4 : 40	III.

Very little, if any, change.

1832·09	86°·3	2″·55	Σ	5 nights.
1879·45	90·2	2·58	β	2 „

No. 119. 41 *Arietis.* Oσ 47.

R.A. 2h 43m 5s
Decl. + 26° 46′

A and B.

1878·917	265°·6	21″·25	3·4...11·0	0 : 30	II.
1879·895	266·1	21·11	...10·5	0 : 00	II.

A and C.

1878·917	203°·7	34″·12	...10·8	0 : 40	II.
1879·895	203·3	33·94	...10·0	0 : 05	II.

A and D.

1879·895	230°·3	125″·81	...8·5	0 : 10	II.
1879·971	230·1	126·00	—	—	II

There seems to be considerable change in C, and perhaps some in B.

1866·53	260°·6	20″·59	De	3 nights	AB.
1879·40	265·8	21·18	β	2 „	
1783·70	189·2	39·33	Hl	1 night	AC.
1867·70	201·4	35·03	De	1 „	
1879·40	203·5	34·03	β	2 nights	
1781·79	260±	125·58	Hl	1 night	AD.
1821·95	226·6	127·55	Sh	1 „	
1879·93	230·2	125·90	β	2 nights	

No. 120. Σ 316. (8·4 and 8·4.)

R.A. 2h 44m 34s
Decl. + 36° 48′

1878·835	135°·0	14″·36	8·5...8·5		
1880·782	134·9	14·45	8·3...8·3	23 : 05	III.

No other recent measures. The change, if any, is small.

1830·02	134°·3	13″·86	Σ	3 nights.
1879·81	135·0	14·40	β	2 „

No. 121. 20 *Persei*. β 524.

R.A. 2h 46m 9s
Decl. + 37° 51′

A and B.

1878·909	328°·1	0″·29	6·0...6·5	0 : 40	V.
1880·060	329·7	0·18	—	3 : 55	V.
1880·725	318·8	0·21	6·0...7·5	2 : 10	V.
1880·824	315·8	0·28	6·0...6·0	22 : 05	V.

AB and C (= Σ 318).

1880·824	236°·9	14″·00	...8·8	22 : 10	V.

There is no change in the position of the distant companion. The close pair is excessively difficult. The following are all the measures:

1878·66	338°·7	0″·34	β	3 nights.
1880·13	323·1	0·29	β	4 „

No. 122. 50 *Arietis*. Σ 49.

R.A. 2h 53m 45s
Decl. + 17° 32′

1880·063	68°·1	1″·56	7·0...9·5	5 : 00	III.

The components have maintained about the same relative position.

No. 123. Σ 337.

R.A. 2h 54m 29s
Decl. + 40° 55′

1880·046	162°·3	17″·07	7·0...8·8	5 : 00	II.
1880·782	162·8	17·80	7·5...8·8	23 : 15	III.
1880·802	163·1	17·46	8·0...9·0	23 : 10	II.

With the exception of a single observation by MA., there are no other measures since STRUVE. There is probably no change.

1832·18	163°·4	17″·76	Σ	2 nights.
1880·54	162·7	17·44	β	3 „

No. 124. γ *Persei*. H. 2170.

R.A. 2h 56m 6s
Decl. + 53° 2′

1879·540	323°·9	57″·72	...10·8	22 : 15	II.
1879·556	323·6	57·72			
1879·55	323·7	57·72			

The prior observations of HERSCHEL and SMYTH are both erroneous in angle, and the latter in distance also.

No. 125. ρ^2 *Eridani*. β 11.

R.A. 2h 56m 50s
Decl. − 8° 9′

1878·854	82°·2	2″·68	6·0...11·0		
1880·104	86·5	2·46	6·0...10·5	3 : 50	III.
1880·911	86·6	2·26	... 9·0	3 : 15	II.

This pair was discovered with the 6-inch, and from the fact that the small star could be seen with the aperture reduced to three inches, and at other times subsequently was difficult, or invisible, with the full aperture, under what seemed to be fair atmospheric conditions, I have been led to suspect variability, but on the

whole this is not very probable. The following are all the measures:

1875·64	87°·2	2″·72	De	5 nights	5·4...	9·6
1877·82	85·9	2·45	Cin	3 „		
1879·95	85·1	2·47	β	3 „	6·0...	10·2

No. 126. 52 *Arietis.* Σ 346.

R.A. 2h 58m 24s
Decl. + 24° 47′

A and B.

1880·725	273°·0	0″·47	—	23 : 40	V.

A and C.

1880·725	351°·3	5″·01	—	23 : 45	V.

A and D.

1879·545	82°·9	101″·56	...10·8	22 : 45	III.
1879·893	82·5	102·23	—	0 : 30	II.
1880·028	84·1	102·82	—	2 : 15	II.
1879·82	83·2	102·20			

The only prior measures of the distant star are by SMYTH, 85°·0 : 105″·0 (1835·88).

No. 127. β *Persei.* (ALGOL.)

R.A. 3h 0m 21s
Decl. + 40° 30′

A and B.

1880·046	155°·2	59″·59	...12·5	3 : 45	III.

A and C.

1880·046	144°·9	68″·77	...11·8	3 : 40	III.

A and D.

1880·046	192°·9	81″·86	...10·0	3 : 30	III.
1880·769	192·2	81·94	...11·0	0 : 35	II.

D and E.

1880·046	118°·4	11″·11	...12·5	3 : 55	III.

There are no other measures of these distant companions with the exception of D, which is given in the Bedford Catalogue, 195°·0 : 55″·0 (1835·63). The mean results of the above measures and some previously published in my first series of observations are as follows:

1878·81	155°·3	59″·06	Var....12·7	AB	3 nights.
1878·81	144·8	68·07	...12·5	AC	3 „
1879·30	192·6	81·91	...10·5	AD	4 „
1878·81	116·2	10·80	...12·5	DE	3 „

The principal star was carefully examined, but no elongation or close companion could be detected.

No. 128. Σ 351.

R.A. 3h 1m 2s
Decl. + 43° 47′

1878·893	118°·3	27″·01	8·5...9·0	—	II.
1880·769	118·3	26·92	8·2...8·3	0 : 45	II.

There are no prior measures of this since STRUVE, and it was therefore put on the working list.

1832·18	119°·6	27″·29	Σ	2 nights.	
1879·83	118·3	26·97	β	2 „	

No. 129. Σ 352. (7·9 and 9·6.)

R.A. 3h 1m 14s
Decl. + 35° 0′

1878·838	1°·8	3″·55	8·0...10·5		
1880·775	1·9	3·25	8·0... 9·2	0 : 00	II.
1880·782	3·0	3·69	7·7... 9·0	23 : 30	III.

This pair has also been neglected by modern observers. The following are all the measures:

1831·52	6°·8	3″·50	Σ	3 nights.
1880·13	2·2	3·50	β	3 „

No. 130. Σ 357. (8·6 and 9·2.)

R.A. 3h 2m 34s
Decl. − 13° 3′

1878·854	295°·8	8″·47	8·5...9·0	—	III.
1878·985	295·3	8·24	8·5...9·0	2 : 15	II.
1879·022	294·9	8·98	—	3 : 00	II.
1880·931	296·8	8·20	8·9...9·5	2 : 40	II.

Only measured by one observer (MADLER) since STRUVE. There would seem to be a decided change in distance. STRUVE gives the magnitudes, 8·5 and 10·3.

1833·05	294°·7	7″·88	Σ	3 nights.
1879·45	295·7	8·47	β	4 „

No. 131. Σ 361.

R.A. 3h 4m 42s
Decl. + 36° 33′

1878·838	15°·5	Clouded.			
1880·775	13·5	9·80	8·0...10·0	0 : 15	II.
1880·782	14·7	10·24	8·2... 9·5	23 : 35	III.

No other measures. Probably fixed.

1830·73	12°·5	9″·90	8·3...11·0	Σ	3 nights.
1880·77	14·6	10·02	8·1... 9·8	β	2 „

No. 132. *Eridani* 103. β 400.

R.A. 3h 5m 16s
Decl. − 4° 16′

1878·977	52°·6	22″·18	6·7...12·0	1 : 50	II.
1879·022	52·9	22·28	6·5...12·0	2 : 50	III.
1879·033	53·8	22·11	6·0...12·0	2 : 30	II.
1879·01	53·1	22·19	6·4...12·0		

No. 132*a*. B.A.C. 990. *O* Σ 52.

R.A. 3h 6m 57s
Decl. + 65° 13′

1878·840	136°·2	0″·44	7·0...8·0	—	V.

A binary system, in slow retrograde motion.

No. 133. Σ 367.

R.A. 3h 7m 52s
Decl. + 0° 18′

1878·867	245°·5	0″·67	8·0...8·0	—	V.
1879·088	247·0	0·58	7·7...7·7	3 : 50	IV.

Undoubtedly a physical pair. Some of the measures are:

1831·72	281°·4	0″·95	Σ	3 nights.
1864·01	257·1	0·5	De	6 „
1878·05	246·0	0·80	III	2 „
1878·98	246·2	0·63	β	2 „

No. 134. *Arietis* 161. β 530. (7·0, 9·7 and 10·4.)

R.A. 3h 8m 18s
Decl. + 22° 30′

B and C.

1880·066	194°·3	1″·72	10·0...10·3	3 : 30	III.
1881·000	196·4	1·40	9·0...10·0	0 : 50	III.

A and B (= Σ 366 *rej.*).

1880·066	41°·3	48″·93	... 7·0	0 : 35	III.
1881·000	41·5	48·65	... 7·0	0 : 55	III.

Combining these with two sets of measures previously made here, we have:

1879·21	195°·8	1″·77	β	4 nights	BC.
1879·21	41·5	48·88	β	4 „	AB.

No. 135. H. 3557.

R.A. 3h 9m 12s
Decl. − 14° 53′

The description of this pair in H. is

9°·9 : 20″ ± : 7½...12, and the declination 1° north of the place given here. There being no bright star in H.'s place, a search was made, and resulted in identifying it as L. 6037. No other measures since H.

1878·942	4°·7	27″·15	8·0...11·0	2 : 40	II.
1880·931	5·3	27·16	8·0...10·7	3 : 00	II.
1880·939	5·8	27·09	8·0...11·5	2 : 35	II.
1880·27	5·3	27·13	8·0...11·1		

No. 136. β 84. (6·4 and 7·5.)

R.A. 3ʰ 10ᵐ 5ˢ
Decl. − 6° 22′

1878·854	35°·2	0″·81	6·5...7·5	—	IV.
1878·931	30·4	0·57	6·3...7·5	3 : 10	V.
1878·985	33·9	0·77	6·5...7·0	2 : 20	III.
1879·088	31·4	0·58	6·5...8·0	3 : 40	IV.
1881·079	31·0	0·86	—	2 : 50	III.

A naked-eye star, and a very difficult pair with the 6-inch with which it was discovered. There is evidence of considerable motion.

1875·85	10°·3	0″·51	De	5 nights.
1879·39	32·4	0·72	β	5 „

No. 137. 95 *Ceti*. A.C. 2.

R.A. 3ʰ 12ᵐ 12ˢ
Decl. − 1° 22′

1878·854 No certain indication of duplicity, but not very steady.
1878·867 Nothing certain with V.

Discovered by ALVAN CLARK with 7½-inch, 1853, and measured by DAWES about that time. Since then it has never been measured, and I have never been able to see it double with any aperture during the last ten years.

No. 138. Σ 377.

R.A. 3ʰ 13ᵐ 43ˢ
Decl. + 18° 45′

A and B.

1880·909	116°·6	0″·86	8·0...8·3	0 : 45	III.

AB and C.

1878·747	222°·2	24″·85			
1880·909	222·3	24·99	...10·0	0 : 50	III.
1879·83	222·2	24·92			

STRUVE called the distant star 11·5 mag. There has not been much change in either angles or distances.

No. 139. τ^4 *Eridani*.

R.A. 3ʰ 14ᵐ 12ˢ
Decl. − 22° 12′

A and B.

1880·022	281°·8	5″·41			

A and C.

1879·997	100°·0	39″·99	...10·5	—	II.

A and D.

1879·950	293°·1	Clouded	—	—	II.
1879·997	293·3	123·08	...10·7	—	II.

A and E.

1879·950	275°·4	—	—	—	II.
1879·997	275·9	130·05	...10·7	—	II.

A and F.

1879·997	236°·0	160″·45	...10·0	—	II.
1880·022	236·2	159·89	—	—	II.

The most distant star was measured by SMYTH, 240°·8 : 150″·0 (1836·90). He does not seem to have seen any of the nearer stars, although they are all easy with a 6-inch aperture.

No. 140. α *Persei*.

R.A. 3ʰ 15ᵐ 45ˢ
Decl. + 49° 26′

1879·540	195°·6	166″·42	...11·0	22 : 35	II.
1879·556	195·4	165·68	...11·0		
1879·54	195·5	166·05	...11·0		

This is one of the Bedford Catalogue stars, SMYTH giving 206°·0 : 75″·0 (1837·64). There are several very faint stars nearer than this.

No. 141. Σ 382.

R.A. 3h 16m 59s
Decl. + 33° 7′

1881·093	157°·8	2″·94	6·0...11·0	4 : 40	II.
1831·70	154·5	3·55	Σ	3 nights.	

The foregoing are all the measures I am acquainted with.

No. 142. Σ 395. (8·1 and 9·0.)

R.A. 3h 21m 26s
Decl. + 28° 39′

1878·909	101°·5	1″·97	8·0...8·7	1 : 15	III.
1881·000	103·0	1·63	8·2...9·3	1 : 05	III.

The following are all the measures of this pair. Evidently the single observation of MADLER belongs to some other pair, or there is an error in the distance.

1832·36	106°·4	1″·92	Σ	3 nights.
1843·14	109·5	3·35	Ma	1 night.
1879·95	102·2	1·80	β	2 nights.

No. 143. Σ 396.

R.A. 3h 23m 55s
Decl. + 58° 22′

1880·675	242°·9	20″·58	7·0...8·3	23 : 00	I.

Without change.

No. 144. Σ 401.

R.A. 3h 24m 5s
Decl. + 27° 10′

1881·093	270°·0	11″·13	7·5...7·6	5 : 00	II.

Relatively fixed.

No. 145. Σ 407. (8·0 and 9·2.)

R.A. 3h 24m 16s
Decl. − 11° 33′

1878·985	47°·9	2″·49	8·0...9·0	2 : 35	II.
1878·994	49·3	2·11	8·0...9·5	2 : 50	II.
1879·030	48·5	2·23	8·0...9·0	2 : 50	II.

A slow advance in the angle, as will be seen from the following:

1833·00	39°·0	2″·33	Σ	3 nights.
1868·22	45·3	2·57	De	5 „
1879·00	48·6	2·28	β	3 „

No. 145*a*. Σ 406. (7·5 and 9·0.)

R.A. 3h 24m 28s
Decl. + 4° 45′

1878·994	124°·8	9″·40	7·0...9·0	3 : 00	II.
1881·025	125·9	9·30	8·0...9·0	3 : 20	II.
1881·068	125·4	9·28	7·5...9·0	3 : 05	II.

There has been no change since first measured.

1836·02	124°·1	9″·36	Σ	3 nights.
1880·36	125·4	9·33	β	3 „

No. 146. Σ 411 *rej.*

R.A. 3h 26m 22s
Decl. − 7° 30′

A and B.

1880·104	88°·2	19″·40	7·0...8·0	6 : 05	II.

A and C.

1880·104	28°·2	37″·69	...10·8	6 : 10	II.

No. 147. *O Σ* 540(=H. 334).

R.A. 3h 26m 27s
Decl. + 31° 41′

1878·917	140°·9	13″·31	8·2...11·5	0 : 50	II.
1880·782	139·2	13·75	8·3...11·0	23 : 50	II.
1881·000	140·5	12·89	8·3...11·0	1 : 20	III.

Without change.

1864·04	142°·2	13″·36	*O Σ*	2 nights.
1880·23	140·2	13·32	*β*	3 „

No. 148. *β* 532. (7·7 and 12·5)

R.A. 3h 27m 25s
Decl. − 10° 27′

1879·088	267°·4	3″·00	8·0...12·5	4 : 10	II.

The mean of the three measures made here is as follows:

1878·29	266°·7	3″·05	*β*	3 nights.

No. 149. *Σ* 410. (7·5 and 11·7.)

R.A. 3h 27m 32s
Decl. + 31° 37′

1878·917	207°·8	5″·44	7·0...11·5	0 : 45	II.
1880·769	207·9	5·47	7·5...11·8	1 : 00	II.
1881·000	210·6	5·10	8·0...11·8	1 : 15	III.

The place of this star in *Pos. Med.* is erroneous, that given being the place of H. 334. There seems to be no motion.

1831·52	208°·8	5″·42	Σ	3 nights.
1880·23	208·8	5·34	*β*	3 „

No. 150. B.A.C. 1101. *β* 533.

R.A. 3h 28m 9s
Decl. + 31° 17′

1878·909	66°·1	0″·42	6·8...7·0	0 : 50	V.

This differs so much from the first measure of *β* 533 (149°·3 : 0″·43 : 1878·67) as to make it almost certain some other star has been observed. This was noted at the time as a very poor measure.

No. 151. *Σ* 422. (6·6 and 9·0.)

R.A. 3h 30m 38s
Decl. + 0° 12′

1878·867	243°·2	6″·41	6·0...8·5	—	V.
1880·931	246·8	6·57	7·0...9·0	3 : 10	II.
1880·939	243·8	6·02	6·7...9·3	2 : 45	II.
1880·942	245·4	6·43	6·8...8·8	1 : 10	II.

De. suspected an elongation of the larger star, but no traces of any such appearance were seen in the foregoing measures. The distance and angle of Struve's companion are slowly increasing.

1832·75	232°·2	6″·13	Σ	3 nights.
1864·86	240·0	6·26	De	5 „
1880·42	244·8	6·35	*β*	4 „

No. 152. *O Σ* 60.

R.A. 3h 31m 59s
Decl. + 24° 19′

1878·867. Certainly single.	—	—		V.

Duplicity uncertain to O Σ, but thought in 1847 to be elongated. Probably not double.

No. 153. *β* 534. (7·5 and 11·1.)

R.A. 3h 33m 1s
Decl. − 8° 54′

1880·104	193°·0	2″·36	8·0...11·5	4 : 10	II.
1881·079	195·9	2·61	7·5...12·0	4 : 25	II.

The mean of these and two prior measures in my first series of observations is:

1879·24	195°·3	2″·40	β	4 nights.

No. 154. *Tauri* 39. Σ 430.

R.A. 3h 34m 8s
Decl. + 4° 44′

A and B.

1878·980	55°·2	25″·95	7·0...8·5	3 : 30	II.
1878·994	55·8	26·06	7·0...9·0	3 : 05	II.
1880·931	55·7	26·01	6·7...8·9	3 : 20	II.

A and C.

1878·980	300°·9	37″·96	...8·7	3 : 20	II.
1878·994	301·0	37·53	...9·0	3 : 15	II.
1880·931	300·9	37·65	...8·7	3 : 25	II.

There is certainly no change in AB; but it is evident there is a considerable error in the distance of C in one of the three sets given below. From the relative fixity of AB, and the close agreement in the measures of De. and those given above, I have previously suggested a clerical or printer's error in Struve's distance of 39″·40. It is obvious if this distance is right, that some of the subsequent measures are much out of the way. If it be true there was no change in the distance of C after 1863, evidently there could have been none prior to that time. Future measures will show.

A and B.

1831·23	55°·3	26″·56	Σ	3 nights.
1863·12	55·5	26·16	De	2 „
1879·08	55·5	26·11	β	4 „

A and C.

1831·23	301°·9	39″·40	Σ	3 nights.
1863·12	301·0	37·76	De	2 „
1879·08	300·9	37·72	β	4 „

No. 155. δ *Persei*.

R.A. 3h 34m 24s
Decl. + 47° 24′

1878·870	313°·3	97″·20	...10·5		
1879·540	312·5	97·27	...10·0	22 : 50	III.
1879·556	312·0	97·86	...10·5		
1879·32	312·6	97·44	...10·3		

One of the Bedford Catalogue stars:

1833·74	315°·0	140″·0	Sm.

No. 156. Σ 437. (9·0 and 9·0.)

R.A. 3h 36m 39s
Decl. + 31° 44′

1880·769	130°·0	11″·52	9·0...9·1	1 : 20	II.
1880·909	130·0	11·35	9·0...9·0	1 : 10	II.

Probably unchanged.

1830·99	128°·6	11″·14	Σ	2 nights.
1880·83	130·0	11·43	β	2 „

No. 157. 19 *Pleiadum*. H. 3251.

R.A. 3h 38m 5s
Decl. + 24° 6′

1879·854	329°·3	66″·52	...10·0	23 : 30	II.
1879·862	329·8	66·71	... 9·0	0 : 15	II.
1880·942	329·7	65.89	6·0...10·0	1 : 25	II.
1880·22	329·6	66·37	6·0... 9·7		

No. 158. *O* Σ 62.

R.A. 3h 38m 10s
Decl. + 64° 23′

1878·840	64°·4	0″·30	8·0...8·0	—	V.

A difficult binary, of which there are but few measures. In 1847 O Σ found the angle 17°·6.

No. 159. Σ 463. (8·7 and 10·5.)

R.A. 3h 45m 26s
Decl. − 0° 2′

1878·994	198°·5	10″·60	8·5... 9·5	3 : 25	II.
1879·030	201·5	11·10	8·5...11·5	3 : 00	II.
1880·939	202·2	10·48	9·0...10·5	2 : 55	II.

The only measure since STRUVE is by MADLER. Probably fixed.

1831·97	203°·5	10″·78	Σ	3 nights.
1879·65	200·7	10·73	β	3 „

No. 160. ζ *Persei*. Σ 464.

R.A. 3h 46m 35s
Decl. + 31° 32′

A and B.

1879·104	207°·4	12″·73	4·0...10·0	4 : 25	III.
1880·066	206·9	12·94	—	—	II.
1880·942	208·9	12·61	... 9·3	1 : 45	II.
1880·04	207·7	12·76			

A and C.

1879·104	286°·0	32″·55	...11·0	4 : 25	III.
1880·942	287·3	32·66	...11·0	1 : 40	II.
1881·000	286·4	32·60	...11·3	1 : 35	II.
1880·35	286·6	32·60			

A and D.

1880·942	198°·0	89″·12	... 9·3	1 : 50	II.

A and E.

1881·000	185°·1	119″·49	...10·0	1 : 40	II.

There is no change in B. The following are the only prior measures of the distant components.

1860·83	290°·0	33″·81	Kn	2 nights.	AC.
1825·01	198·8	84·38	S	2 „	AD.
1825·01	184·6	119·07	S	2 „	AE.

No. 161. β 743.

R.A. 3h 46m 36s
Decl. + 51° 54′

1880·060	250°·2	0″·82	8·5...9·0	5 : 50	III.

One of the Mount Hamilton stars, discovered with the 6-inch. The above is the only measure made thus far.

No. 162. Σ 466. (8·1 and 9·7.)

R.A. 3h 47m 8s
Decl. − 2° 21′

1878·994	62°·1	8″·15	8·0... 9·5	3 : 35	II.
1879·030	60·7	8·02	8·0...10·0	3 : 15	II.
1880·939	62·0	7·82	8·3... 9·5	3 : 05	II.

Evidently unchanged since STRUVE.

1831·73	59°·7	8″·08	Σ	3 nights.
1879·65	61·6	8·co	β	3 „

No. 163. *Persei* 189. Σ 469.

R.A. 3h 49m 6s
Decl. + 41° 32′

1880·046	147°·8	8″·70	7·0... 9·0	6 : 25	II.
1880·769	148·2	8·88	7·8...10·0	1 : 30	II.

No other measures in the last fifty years.

1828·70	148°·7	9″·15	Σ	2 nights.
1880·40	148·0	8·79	β	2 „

No. 164. Σ 473. (8·5 and 9·4)

R.A. 3h 51m 25s
Decl. + 9° 17′

1878·994	93°·9	16″·81	8·5... 9·0	3 : 45	II.
1879·030	94·1	16·55	8·5... 9·2	3 : 20	II.
1880·066	94·0	16·51	8·5...10·0	4 : 00	II.

These measures make a larger distance than that given by STRUVE, but the difference is probably due to errors of observation.

1829·16	95°·1	16″·08	Σ	2 nights.
1879·36	94·0	16·62	β	3 „

No. 165. Σ 476.

R.A. 3h 53m 36s
Decl. + 38° 20′

1880·046	285°·2	19″·92	7·8...8·8	6 : 35	II.
1880·769	285·5	19·88	8·4...8·8	1 : 40	II.

Certainly moving; probably proper motion.

1831·85	283°·8	17″·58	Σ	3 nights.
1864·92	284·7	19·16	De	5 „
1880·40	285·3	19·90	β	2 „

No. 166. Σ 487. (8·6, 8·9 and 9·2)

R.A. 3h 55m 12s
Decl. − 10° 47′

A and B.

1878·980	8°·3	12″·50	9·0...9·3	3 : 35	II.
1880·920	9·3	12·15	8·3...8·5	3 : 20	II.

A and C.

1878·980	234°·8	21″·66	...9·5	3 : 45	II.
1880·920	236·3	21·46	...8·9	3 : 25	II.

The components seem to have remained nearly constant.

1831·40	8°·7	11″·93	Σ	3 nights	AB.
1879·95	8·8	12·32	β	2 „	
1831·40	237·4	21·73	Σ	3 „	AC.
1879·95	235·5	21·56	β	2 „	

No. 167. B.A.C. 1224. OΣ 70.

R.A. 3h 55m 14s
Decl. + 9° 40′

1879·030	228°·1	11″·68	6·2...11·5	3 : 40	II.

Without change.

No. 168. Σ 483.

R.A. 3h 56m 2s
Decl. + 39° 11′

1880·046	353°·1	1″·13	7·0...9·0	6 : 10	II.

Angle and distance steadily decreasing.

1830·52	11°·6	2″·80	Σ	3 nights.
1864·64	0·4	1·67	De	5 „

No. 169. OΣ 71.

R.A. 3h 59m 16s
Decl. + 33° 8′

A and B.

1878·909	203°·8	1″·08	7·0...10·0	1 : 25	IV.

A and C (=H. 671).

1878·909	119°·0	34″·68	...12·5	1 : 35	IV.

H. did not see B, and OΣ has no measure of C. Very little, if any, change in the close pair.

No. 170. Σ 493. (8·1 and 8·3)

R.A. 4h 0m 22s
Decl. + 5° 22′

1879·104	91°·9	1″·55	8·0...8·2	4 : 10	III.
1880·997	92·2	1·37	8·3...8·5	4 : 00	II.

Only measured by MADLER since STRUVE, until the late measures here given. There would seem to be some angular motion.

1831·68	98°·1	1″·83	Σ	3 nights.
1879·66	92·9	1·67	Cin	2 „
1880·05	92·0	1·46	β	2 „

No. 171. OΣ 72.

R.A. 4h 1m 7s
Decl. + 17° 1′

1880·066	328°·3	4″·26	6·7...10·0	—	II.
1880·997	329·1	4·51	6·8... 9·8	4 : 10	III.

There may be some change in the angle.

1854·51	322°·8	4″·49	0 Σ	5 nights.
1867·44	325·3	4·37	De	3 „
1880·53	328·7	4·38	β	2 „

No. 172. Σ 497. (8·2 and 9·1.)

R.A. 4h 2m 3s
Decl. + 8° 8′

1878·985	232°·7	13″·37	8·5...9·2	3 : 05	II.
1878·994	232·0	13·29	8·0...9·0	4 : 00	II.

The measures indicate some little change.

1829·98	236°·3	14″·32	Σ	2 nights.
1878·98	232·3	13·33	β	2 „

No. 173. Σ 498.

R.A. 4h 3m 22s
Decl. + 53° 28′

1878·840	171°·6	1″·81	9·0...10·5	—	III.

The following are all the prior measures. The distance by Se. may be a misprint for 1″·45.

1833·24	173°·6	1″·04	Σ	5 nights.
1858·01	174·9	0·45	Se	1 night.

No. 174. Σ 510. (7·3 and 9·5.)

R.A. 4h 5m 59s
Decl. + 0° 26′

1880·104	300°·8	10″·87	6·8... 8·8	6 : 15	II.
1880·997	300·9	11·17	7·0...10·3	4 : 20	III.
1881·025	302·4	11·15	8·0... 9·5	3 : 35	II.

Probably unchanged.

1831·02	300°·5	10″·76	Σ	2 nights.
1880·71	301·4	11·05	β	3 „

No. 175. μ *Persei*. O Σ 73.

R.A. 4h 6m 5s
Decl. + 48° 6′

1878·840	348°·7	14″·69	...12·5	—	III.

The following are all the measures of this star:

1851·08	349°·2	15″·07	0 Σ	3 nights.
1878·50	348·7	14·78	β	2 „

No. 176. Σ 514.

R.A. 4h 6m 49s
Decl. − 7° 9′

1880·022	73°·4	7″·71	8·5...10·3	3 : 40

Unchanged.

No. 177. 47 *Tauri* β 547.

R.A. 4h 7m 25s
Decl. + 8° 58′

1878·867	360°·0	0″·96	5·0...10·0	—	III.
1878·931	358·8	0·87	5.0... 8·5	4 : 20	V.
1879·000	360·5	0·84	5·0... 8·5	4 : 35	IV.

The means of all my measures, and of those by De. are as follows:

1877·90	359°·7	0″·82	De	3 nights.
1878·42	359·7	0·89	β	6 „

No. 178. Σ 511.

R.A. 4h 7m 51s
Decl. + 58° 30′

1878·840	288°·4	0″·49	7·5...7·7	—	V.

There has been very little change in the distance of this binary. Some of the previous measures are:

1829·52	320°·0	0″·54	Σ	4 nights.
1845·14	316·2	0·65	O Σ	3 „
1866·30	293·5	0·41	En	2 „
1879·85	286·8	0·40	Hl	3 „

No. 179. *OΣ* 75.

R.A. $4^h\ 8^m\ 19^s$
Decl. $+\ 60°\ 12'$

1878·840	164°·2	0″·48	7·8...8·2	—	V.

There is but little motion since the first measures in 1843.

No. 180. 40 *Eridani*. Σ 518.

R.A. $4^h\ 9^m\ 52^s$
Decl. $-\ 7°\ 47'$

B and C.

1878·931	126°·2	3″·60	9·0...11·5	3 : 45	III.
1879·066	126·1	3·42	9·0...11·5	4 : 30	III.
1879·088	125·4	3·56	—	4 : 20	III.
1879·104	123·8	3·39	—	4 : 40	III.
1880·030	121·4	3·51	9·0...11·0	4 : 00	II.
1880·063	121·3	3·43	9·0...11·5	5 : 40	III.
1880·102	119·3	3·18	—	5 : 05	III.
1880·104	122·6	3·32	—	6 : 30	II.
1880·153	124·4	3·16	—	5 : 45	II.
1880·909	121·2	2·99	—	4 : 30	II.
1880·911	122·8	3·19	—	4 : 00	II.
1880·942	122·5	3·55	—	2 : 40	II.
1880·997	122·8	2·91	—	4 : 30	II.
1881·008	121·0	3·16	—	3 : 40	II.
1881·835	121·4	3·15	—	4 : 15	III.
1881·840	118·0	3·25	—	3 : 05	II.
1881·843	118·4	3·59	—	1 : 25	III.
1881·845	—	3·60	—	3 : 35	II.
1881·859	119·7	3·69	—	2 : 30	I.
1881·862	117·5	3·92	—	3 : 05	I.

A and *a*.

1878·931	137°·6	36″·37	...12·0	3 : 50	III.
1878·977	137·0	35·61	...12·0	2 : 15	II.
1880·030	131·8	34·95	...11·8	4 : 00	II.

A and B.

1878·977	105°·5	81″·15	... 9·0	2 : 25	II.
1880·153	107·1	81·01	—	5 : 50	II.
1879·56	106·3	81·08			

Special attention has been given to the close pair in consequence of its neglect by other observers. It is well known that B and C have the same large proper motion as the principal star. The last series of measures (1881) were made at Mount Hamilton with the 12-inch refractor of the Lick Observatory. The mean results of my measures, with the set already given in my first series of observations, are as follows:

1877·86	128°·2	3″·92	6 nights.
1879·05	125·4	3·66	4 „
1880·09	121·3	3·28	5 „
1880·95	122·0	3·16	5 „
1881·84	119·0	3·53	6 „
1883·00*	119·2	3·07	2 „

The faint star *a* does not belong to the system, as will be seen by the following:

1864·84	185°·0	75″·85	Wn	1 night.
1877·80	145·6	37·10	β	3 nights.
1878·95	137·3	35·99	β	2 „
1880·03	131·8	34·95	β	1 night.

No. 181. 55 *Tauri*. *OΣ* 79.

R.A. $4^h\ 13^m\ 2^s$
Decl. $+\ 16°\ 14'$

1879·000	58°·2	0″·44	6·5...7·5	4 : 25	IV.

Slow direct motion in angle.

No. 182. Σ 527.

R.A. $4^h\ 13^m\ 13^s$
Decl. $-\ 7°\ 43'$

1880·079	190°·3	6″·38	8·0...9·5	4 : 30	II.
1880·104	193·5	5·91	8·2...8·7	6 : 40	II.
1880·09	191·9	6·14	8·1...9·1		

A probable increase in distance, as Σ found it 5″·52.

* Measures made while this work was passing through the press.

No. 183. δ *Tauri.* H vi. 101.

R.A. $4^h\ 18^m\ 33^s$
Decl. + 17° 38′

1878·985	232°·4	77″·00	...9·0	4 : 15	II.
1879·030	232·9	76·52	...9·5	4 : 30	II.

There would seem to be a change in distance. The following are all the measures:

1783·74	234°·6	63″·62	H	1 night.
1879·00	232·6	76·76	β	2 nights.

No. 184. Σ 547.

R.A. $4^h\ 19^m\ 48^s$
Decl. − 1° 40′

1878·985	15°·6	2″·21	9·0...12·5	3 : 15	II.
1879·030	14·1	2·07	9·0...12·5	4 : 20	II.
1879·088	12·7	2·31	—	4 : 30	III.
1879·102	13·8	2·46	9·0...11·5	5 : 40	III.
1880·030	17·5	2·39	9·0...11·5	3 : 45	II.
1880·063	14·7	2·15	9·0...12·0	5 : 50	II.
1880·911	15·5	2·04	9·0...12·0	4 : 10	II.
1880·942	18·5	2·12	8·8...11·0	2 : 50	II.
1881·074	14·5	2·26	9·0...12·0	4 : 25	II.
1881·845	—	2·51	9·0...11·8	4 : 30	I.
1881·862	14·2	2·54	9·0...12·0	3 : 50	I.
1881·865	15·5	2·14	9·0...12·0	1 : 45	II.

Dembowski was unable to see the companion in 1865, and until recently there were no measures since Struve's. The change may be due to proper motion.

1831·39	344°·3	4″·25	Σ	3 nights.
1877·99	9·8	2·31	β	3 „
1879·05	14·0	2·26	β	4 „
1880·60	16·1	2·19	β	5 „
1881·85	14·8	2·40	β	3 „

The last three measures of 1881 were made with the 12-inch refractor of the Lick Observatory at Mount Hamilton.

No. 185. O Σ 83.

R.A. $4^h\ 22^m\ 56^s$
Decl. + 32° 11′

1879·000.	Apparently round.	—	—	V

Suspected double by O Σ 1846–7, but single to all observers since.

No. 186. 80 *Tauri.* Σ 554.

R.A. $4^h\ 23^m\ 17^s$
Decl. + 15° 23′

1879·000	7°·4	0″·57	6·0 ..9·5	4 : 50	IV.

Probably binary, and now a difficult pair. The change is principally in the distance, which at the time it was measured by Σ was 1″·74.

No. 187. *Aldebaran.* β 550.

R.A. $4^h\ 29^m\ 2^s$
Decl. + 16° 16′

1879·104	111°·6	31″·74	1·0...14·0	5 : 00	III.
1881·137	110·8	31·19	...14·0	5 : 10	IV.

A and C (Σ 2, App. II.).

1880·066	35°·3	114″·61	—	—	II.
1881·137	34·8	115.50	—	5 : 20	III.
1880·60	35·0	115·05			

The following are all the measures of the faint companion:

1877·89	109°·0	30″·45	β	3 nights.
1878·00	110·5	31·26	III	3 „
1880·12	111·2	31·46	β	2 „

No. 188. O Σ 86.

R.A. $4^h\ 29^m\ 28^s$
Decl. + 19° 31′

1880·030	68°·6	0″·48	7·7...7·7	4 : 40	IV.

The prior measures are somewhat discordant, and on the whole show but little change.

No. 189. Σ 571.

R.A. 4h 30m 3s
Decl. − 3° 51′

1878·985	258°·2	17″·33	7·0...9·0	3 : 40	II.
1880·942	259·2	17·40	7·0...9·3	3 : 00	II.

The components appear to be fixed. Combining with the above a prior measure in 1878 we have:

1830·74	258°·7	17″·84	Σ	3 nights.
1879·31	258·5	17·34	β	3 „

No. 190. Σ 585. (8·7 and 10·7.)

R.A. 4h 36m 58s
Decl. + 4° 36′

1878·985	274°·9	12″·31	9·0...10·5	4 : 10	II.
1880·942	275·9	11·89	8·5...10·7	3 : 10	II.
1881·008	275·0	11·76	8·5...11·0	4 : 10	II.

Not seen by De. in 1865. The only measure since Σ is by Ma. Evidently unchanged:

1831·79	275°·9	12″·11	Σ	3 nights.
1880·31	275·3	11·99	β	3 „

No. 191. Σ 607.

R.A. 4h 45m 47s
Decl. + 25° 18′

1878·985	249°·0	14″·07	9·0...9·5	4 : 40	II.
1882·162	248·8	14·35	9·0...9·7	7 : 15	III.

There does not appear to be any change. The measures given above are combined with three previous observations:

1831·19	249°·9	14″·21	Σ	3 nights.
1879·02	249·7	14·10	β	5 „

No. 192. H. 3705.

R.A. 4h 51m 25s
Decl. − 16° 20′

1879·030	141°·3	22″·46	7·5... 8·8	4 : 35	II.
1881·008	140·9	21·86	7·8...10·7	4 : 25	II.
1881·079	140·9	22·56	—	4 : 55	II.
1880·37	141·0	22·29	7·6...9·7		

The distance has never before been measured. H. gave the angle 139°·3 (1835·9).

No. 193. Σ 622.

R.A. 4h 51m 52s
Decl. + 1° 29′

1880·104	175°·0	2″·43	8·0...8·1	7 : 00	II.
1881·074	173·2	2·46	8·0...8·0	4 : 40	II.

There may be a little change in the angle, as Σ found 179°·9.

No. 194. *Orionis* 26. Sh. 49.

R.A. 4h 52m 11s
Decl. + 14° 22′

A and B.

1880·063	304°·4	39″·02	6·6...8·0	—	II.
1881·093	305·4	39·19	—	5 : 20	II.

A and C.

1879·997	87°·4	54″·16	...8·8	—	II.
1880·063	88·3	54·24	...9·0	—	II.
1881·093	88·1	54·70	—	5 : 25	II.

The components appear to be fixed. There are no early measures of C except by Smyth, 88°·3 : 70″·0 (1831·95). Hl's distance, 36″·43, undoubtedly belongs to B.

1783·73	303°·6	34″·±	Hl	1 night	AB.
1822·09	304·6	38·83	Sh	2 nights	
1874·44	304·9	39·22	De	2 „	
1880·57	304·9	39·11	β	2 „	
1874·44	88·4	54·68	De	2 „	AC.
1880·38	87·9	54·37	β	3 „	

No. 195. *Eridani* 387. H. 689.

R.A. 4h 52m 8s
Decl. − 2° 24′

1880·104	276°·7	20″·60	6·5...10·8	7 : 00	II.
1881·151	274·5	20·74	7·3...12·0	5 : 25	II.

This star has not been measured before. H. estimated the distance 10″.

No. 196. ϵ *Aurigæ*. β 554.

R.A. 4h 53m 21s
Decl. + 43° 39′

A and B.

1878·893	224°·5	29″·31	...14·0	—	III.

A and C.

1878·046	275°·9	42″·88	...12·0		
1878·893	274·4	42·31	...12·0		
1878·900	275·6	42·84	...12·0	1 : 40	II.
1880·046	275·4	43·60	...10·8	6 : 50	II.
1878·97	275·3	42·91	...11·7		

A and D.

1878·893	317°·6	46″·38	...13·0	—	III.
1880·046	316·7	46·36	...11·5	6 : 50	II.
1879·47	317·1	46·37	...12·2		

The nearest star was not noticed at the time when first catalogued. The distance of the star called C in my first series of measures, given as 51″·79, seems to have been wrongly read if it is identical with D.

No. 196*a*. 66 *Eridani*. Σ 642 *rej.*

R.A. 5h 0m 48s
Decl. − 4° 49′

1879·909	9°·3	52″·25	6·0...9·0	—	II.
1879·997	9·4	52·74	...9·5		
1879·95	9·4	52·50	6·0...9·2		

Smyth gives 13°·8 : 47″·0 (1832·01). There are no other measures.

No. 197. 103 *Tauri*. (Edgecomb.)

R.A. 5h 0m 48s
Decl. + 24° 6′

A and B.

1878·980	147°·9	12″·94	6·0...12·13	4 : 30	II.

A and C. (ℍ v. 114.)

1878·980	197°·0	34″·98	... 9·0	4 : 40	II.

The nearest star was detected by Edgecomb with 9·4-inch in 1878. The only prior measure of AC is by ℍ, 197°·6 : 30″·05 (1783·80).

No. 198. β *Eridani*. (Smyth.)

R.A. 5h 1m 59s
Decl. − 5° 15′

1879·909	143°·9	116″·60	...10·5	—	II.
1879·997	143·3	116·76	...10·8		
1879·95	143·6	116·68	...10·6		

Smyth gives, 147°·5 : 120″·0 (1830·98).

No. 199. *O Σ* 100. (7·4 and 10·2.)

R.A. 5h 3m 28s
Decl. + 8° 2′

1878·991	252°·2	3″·97	7·5...10·0	4 : 50	II.
1878·994	251·6	3·94	6·8...10·5	4 : 50	II.
1881·137	252·7	3·76	7·8...10·0	5 : 45	III.

There is very little change in this pair.

1848·51	247°·2	4″·32	O Σ	3 nights.
1867·45	249·8	4·09	De	3 „
1879·71	252·2	3·89	β	3 „

No. 200. H. 3269.

R.A. 5h 5m 4s
Decl. + 16° 36′

1879·997	61°·8	19″·49	8·2... 9·5		
1880·066	60·1	19·93	8·0...10·0	4 : 50	II.
1880·03	60·9	19·71	8·1... 9·7		

No prior measures except Smyth's.

No. 201. ι *Leporis.* Σ 655.

R.A. 5h 6m 42s
Decl. − 12° 1′

1879·145	337°·3	12″·25	...10·5	4 : 45	II.
1881·046	337·8	12·49	5·5... 9·0	5 : 25	III.
1881·079	338·4	12·54	—	5 : 05	II.
1880·42	337·8	12·43			

Very little change since STRUVE.

No. 202. κ *Leporis.* Σ 661.

R.A. 5h 7m 40s
Decl. − 13° 5′

1879·145	358°·2	2″·96	5·0...9·5	4 : 50	II.
1881·046	361·6	2·51	5·0...7·5	5 : 15	III.
1881·079	362·4	2·55	—	5 : 05	II.
1880·42	360·7	2·67	5·0...8·5		

Probably fixed.

No. 203. α *Aurigæ.*

R.A. 5h 7m 49s
Decl. + 45° 53′

A and B.

1878·893	317°·5	78″·17	...14	—	II.

A and D.

1878·893	315°·8	143″·21	...11	—	II.

A and E (Ḥ vi. 30).

1878·900	146°·0	158″·01	...10	1 : 55	II.

Another star, C, 183°·2 : 126″ (1878·04), is given in my first series of measures. The stars nearer than E have not been observed before.

No. 204. β *Orionis.* β 555.

R.A. 5h 8m 47s
Decl. − 8° 20′

B and C.

1881·151	Possibly elongated, but doubtful.				V.

This star was examined many times in 1880, 1881, and 1882, with similar results.

No. 205. Σ 657.

R.A. 5h 9m 11s
Decl. + 52° 43′

1878·840	28°·2	1″·24	8·0...8·5		V.

A small increase in the angle is probable.

No. 206. λ *Aurigæ.*

R.A. 5h 10m 39s
Decl. + 40° 0′

A and B.

1878·893	196°·0	40″·65	...13·0	—	II.
1878·900	198·3	40·69	...13·0	1 : 25	II.
1880·046	198·4	40·08	...12·0	9 : 50	II.
1879·28	197·6	40·47	12·2		

A and C (Σ 3, App. II.)

1878·893	14°·4	121″·43	...10·0	—	II.
1878·906	13·4	121·00	...10·0	1 : 20	II.
1880·046	13·1	122·16	... 9·0	9 : 55	II.

The nearest companion is new. The change in the HERSCHEL star is due to proper motion.

1836·21	29°·0	103″·60	Σ	3 nights.
1864·10	18·4	114·39	De	3 „
1879·28	13·6	121·53	β	3 „

No. 207. Σ 681.

R.A. 5h 11m 42s
Decl. + 46° 50′

1878·893	180°·8	23″·21	7·0...8·5		II.

No other measures since Σ, but evidently fixed, as Σ found 180°·5 : 23″·40 (1831·95).

No. 208. *τ Orionis.* β 188.

R.A. 5h 11m 47s
Decl. − 6° 58′

B and *b*.

1879·102	51°·2	4″·24	11·0...13·0	5 : 50	IV.

The mean of four measures of the close pair is:

1878·26	50°·8	4″·10	β	4 nights.

No. 209. H. 3272.

R.A. 5h 11m 48s
Decl. + 39° 14′

A and B.

1879·854	341°·6	19″·53	8·0...11·5	0 : 00	II.
1879·852	341·8	19·64	...11·0	0 : 40	II.
1879·86	341·7	19·58	8·0...11·2		

A and C.

1879·854	296°·2	28″·95	...12·0	0 : 05	II.
1879·862	293·9	29·78	...11·5	0 : 45	II.
1879·86	295·0	29·36	11·7		

A and D.

1879·854	42°·8	33″·31	...11·0	0 : 10	II.
1879·862	42·7	33·65	...10·5	0 : 45	II.
1879·86	42·7	33·48	10·7		

With the exception of a measure of D by SMYTH, these distant companions have not been measured before.

No. 210. S. 473. (7·0 and 8·2.)

R.A. 5h 12m 10s
Decl. − 15° 21′

1878·994	305°·7	20″·66	7·0...8·0	5 : 00	II.
1880·997	305·7	—	—	—	II.
1881·046	305·4	20·61	7·0...8·5	5 : 35	III.

The following are all the measures:

1825·06	304°·0	20″·84	S	3 nights.
1880·35	305·6	20·63	β	3 „

No. 211. *Orionis* 82. β 190.

R.A. 5h 14m 38s
Decl. − 8° 9′

A and B.

1879·102	2°·5	0″·47	8·0...8·0	5 : 20	V.
1881·151	7·7	0·58	—	5 : 45	IV.
1881·175	2·0	0·57	—	6 : 00	IV.

This is the principal star of Σ 692, about 6m following *β Orionis* and 10′ north. There is no change in the STRUVE star. The following are all the measures of the close pair:

1876·15	355°·3	0″·61	De	4 nights.
1879·88	3·8	0·53	β	4 „

No. 212. *Leporis* 28. H. 3750.

R.A. 5h 15m 20s
Decl. − 21° 22′

1879·131	283°·3	4″·26	6·0...10·5	5 : 20	II.

A finer pair than most of H.'s double stars. He found for the angle 295°·3 (1835·90).

No. 213. B.A.C. 1657. II. 697.

R.A. 5h 15m 24s
Decl. − 0° 32′

A and B.

1878·994	59°·8	32″·40	6·0...13·0	5 : 10	II.

A and C.

1878·994	109°·8	36″·81	...12·0	5 : 20	II.

These stars have never been measured before.

No. 214. 111 *Tauri*. S. 478.

R.A. $5^h\ 17^m\ 25^s$
Decl. $+\ 17^\circ\ 16'$

1879·030	270°·9	75″·10	5·5...8·0	4 : 50	II.
1879·104	270·5	74·59	6·0...8·5	5 : 20	II.

The change comes from the proper motion of the larger star:

1825·06	271°·3	61″·76	S	2 nights.
1879·07	270·7	74·84	*β*	2 „

No. 215. *η Orionis*. Da. 5.

R.A. $5^h\ 18^m\ 27^s$
Decl. $-\ 2^\circ\ 30'$

1879·107	81°·9	1″·06	4·0...5·5	6 : 00	IV.

This easy pair has been very often measured. The observations taken together do not show much change since its discovery in 1848.

No. 215*a*. *β* 556.

R.A. $5^h\ 18^m\ 39^s$
Decl. $-\ 2^\circ\ 36'$

1878·170	238°·2	0″·79	6·5...11·8		
1879·107	247·2	0·74	7·0...12·5	5 : 50	IV.

A difficult pair in the field with *η Orionis*. These are all the measures. The first is taken from my first series of observations already published. It would be hardly safe to infer motion in a star so difficult to measure.

No. 215*b*. *γ Orionis*. (Smyth.)

R.A. $5^h\ 18^m\ 42^s$
Decl. $+\ 6^\circ\ 14'$

1879·909	143°·4	178″·49	...11·0	—	II.
1879·997	144·4	177·87	...11·8	—	II.
1879·95	143·9	178·18	...11·4		

No. 216. De. 8.

R.A. $5^h\ 20^m\ 10^s$
Decl. $+\ 34^\circ\ 19'$

1878·909	328°·7	21″·02	8·5...10·0	2 : 00	III.

A wide pair in the field with Σ 707. The only other measures are by De., 329°·0 : 20″·88 (1864·79) 3 n.

No. 217. 115 *Tauri*. *O Σ* 107.

R.A. $5^h\ 20^m\ 10^s$
Decl. $+\ 17^\circ\ 52'$

1879·030	306°·2	9″·88	5·7...11·5	5 : 00	II.
1879·044	306·9	9·95	6·0...11·5	4 : 50	II.
1879·104	306·5	9·96	6·0...11·0	5 : 30	II.

The small star has remained fixed.

1849·54	304°·9	10″·15	*O Σ*	3 nights.
1867·93	307·6	9·89	De	3 „
1878·76	307·0	9·99	*β*	4 „

No. 218. *β* 319.

R.A. $5^h\ 21^m\ 15^s$
Decl. $-\ 20^\circ\ 49'$

1879·131	226°·6	3″·72	7·8...11·5	5 : 25	II.

In a low-power field with *β Leporis*. The only other measures are:

1876·09	231°·3	3″·98	III	3 nights.
1877·11	228·1	3·80	Cin	2 „

No. 219. O.Σ 108.

R.A. 5h 22m 18s
Decl. + 18° 16′

1880·164	133°·7	3″·24	7·8...10·5	—	II.

Without change.

No. 220. H. 2268.

R.A. 5h 22m 57s
Decl. − 8° 28′

1879·879	299°·9	25″·87	7·0... 9·0	—	II.
1879·597	300·3	26·19	7·0...10·3	—	II.
1879·95	300·1	26·03	7·0... 9·6		

No. 221. S. *Orionis*.

R.A. 5h 23m 5s
Decl. − 4° 47′

1879·142	227°·5	46″·72	8·0...9·0	—	II.
1879·145	227·3	46·67	8·0...9·3	—	II.
1879·14	227·4	46·70	8·0...9·2		

The principal star is variable. Discovered by Rev. T. W. WEBB.

No. 222. β *Leporis*. β 320.

R.A. 5h 23m 6s
Decl. − 20° 51′

1878·867	284°·7	2″·60	...11·0	—	III.
1878·931	280·7	2·37	...10·5	5 : 00	III.
1879·000	285·4	2·64	...11·0	5 : 50	III.
1879·102	286·2	2·47	...11·6	6 : 00	IV.
1879·879	287·0	2·45	—	—	II.
1881·044	283·5	2·69	—	4 : 45	III.
1881·046	284·5	2·62	—	5 : 10	III.
1879·47	284·6	2·54	...10·9		

The earlier measures of this pair led to the conclusion that the small star had considerable angular motion, but the later observations do not confirm this. Two distant stars were measured to identify the one noted in the 'Cycle.' It is uncertain which of these stars SMYTH measured in finding, 67°·5 : 210″·0 (1832·00).

1879·879	75°·0	206″·36	...10	AD.
1879·879	57·6	241·53	...10	AE.

No. 223. 31 *Orionis*. Σ 725.

R.A. 5h 23m 37s
Decl. − 1° 11′

1880·104	86°·9	12″·09	5·0...10·0	7 : 35	II.
1880·909	86·1	12·10	6·0...11·0	4 : 55	II.
1880·958	86·5	12·17	—	6 : 05	II.

Probably unchanged.

1829·41	87°·5	12″·74	Σ	3	nights.
1879·07	88·4	12·71	Cin	2	„
1880·66	86·5	12·12	β	3	„

No. 224. 32 *Orionis*. Σ 728.

R.A. 5h 24m 22s
Decl. + 5° 51′

1879·000	197°·1	0″·52	5·0...7·5	6 : 10	V.

Binary, and now only half the distance measured by STRUVE.

No. 225. δ *Orionis*. β 558.

R.A. 5h 25m 52s
Decl. − 0° 23′

A and B.

1880·173	226°·6	31″·72	...14·0	6 : 10	III.

A and C. (Σ 14, App. I.)

1880·173	1°·1	52″·36	... 8·0	6 : 15	III.

From a mean of all the measures of B we have:

1878·46	226°·9	33″·27	β	4 nights.

No. 226. Sh. 61.

R.A. 5h 26m ±
Decl. + 2° 42′ ±

1879·044	352°·0	66″·86	8·0...8·5	5 : 00	II.

The only other measure is:

1822·97	353°·1	68″·91	Sh	1	night.

No. 227. Σ 734.

R.A. 5h 27m 3s
Decl. − 1° 48′

A and B.

1878·991	354°·9	1″·75	8·0...9·5	5 : 05	II.

A and C.

1878·998	242°·8	29″·19	...9·0	5 : 15	II.
1879·044	242·9	29·75	...8·5	5 : 20	II.
1879·02	242·8	29·47	...8·7		

No other measure since STRUVE. Probably unchanged.

No. 228. λ *Orionis*. Σ 738.

R.A. 5h 28m 32s
Decl. + 9° 51′

A and B.

1880·066	44°·3	4″·16	—	5 : 20	II.
1880·958	45·6	4·37	—	6 : 10	III.
1880·51	44·9	4·27			

A and C.

1880·066	182°·7	28″·66	—	5 : 25	II.
1880·102	(174·3)	28·82	...11·0	5 : 40	II.
1880·909	183·7	28·58	...11·0	5 : 05	II.
1880·958	183·0	28·57	...10·8	6 : 15	II.
1880·68	183°·1	28″·66			

The second angle of C is rejected in the mean. There is probably an error of 10° in reading. SECCHI's distance, 23″·16, of this star is probably erroneous, and may be a misprint for 28″·16. Σ speaks of a star, 184° : 27″. There is very little change in the closer star.

No. 229. Σ 745.

R.A. 5h 28m 57s
Decl. − 6° 5′

1878·985	346°·1	28″·70	8·0...8.2	5 : 10	II.
1881·044	346·6	28·79	8·0...8·2	5 : 15	III.
1880·01	346·3	28·74	8·0...8·2		

Without change.

No. 230. θ *Orionis*. Σ 748.

R.A. 5h 29m 23s
Decl. − 5° 28′

Sixth Star.

1878·985	119°·1	3″·30	6·5...12·0	4 : 50	II.
1878·991	124·3	3·15	...12·0	5 : 00	II.
1879·000	120·6	3·77	...12·0	5 : 45	III.
1879·107	121·7	3·48	...11·5	6 : 10	III.
1880·030	119·4	3·45	...11·5	5 : 00	III.
1880·102	119·2	3·40	...11·0	5 : 05	III.
1879·37	120·7	3·42	...11·7		

I have looked at this group hundreds of times in the last ten years, and have never been led to suspect the slightest variability or change in either the fifth or sixth star. The condition of the seeing at the time will account, I think, for all the supposed fluctuations in the light of these stars.

No. 231. ε *Orionis.* (SMYTH.)

R.A. 5h 30m 6s
Decl. − 1° 17′

1879·879	56°·8	180″·01	...9·5	—	II.
1879·909	57·3	179·84	—	—	II.
1879·89	57·0	179·92			

The only other measures are those in the 'Cycle.'

No. 232. β 89. (8·0 and 9·2.)

R.A. 5h 31m 29s
Decl. − 1° 30′

1879·000	0°·3	0″·62	8·0... 9·0	6 : 00	V.
1879·102	3·8	0·62	8·0... 9·0	6 : 10	IV.
1879·107	1·1	0·88	8·0...10·0	6 : 20	IV.
1881·044	354·5	0·75	Poor seeing	5 : 05	IV.
1881·151	1·1	0·82	8·0... 9·0	6 : 00	IV.

A difficult pair near ε *Orionis.* There seems to be considerable angular motion. The fourth measure above, which was made under very unfavourable conditions, is omitted in the mean result. The following are all the measures:

1875·68	344°·2	0″·55	De	3 nights.
1878·40	356·1	0·81	Cin	2 „
1879·59	1·6	0·73	β	4 „

No. 233. *O Σ* 112.

R.A. 5h 31m 39s
Decl. + 37° 53′

1878·840	77°·6	0″·72	7·5...7·5	—	V.
1880·725	77·1	0·66	7·6...7·7	2 : 45	V.
1879·78	77·3	0·69	7·5...7·6		

Very slow retrograde motion.

No. 234. Σ 755.

R.A. 5h 31m 52s
Decl. + 23° 13′

1879·854	314°·1	5″·67	8·0...8·3	1 : 20	II.
1879·862	315·4	6·27	—	1 : 25	II.
1881·000	317·8	6·08	8·3...8·7	3 : 05	II.
1880·24	315·8	6·01	8·2...8·5		

There has been no change since STRUVE. Two very distant stars, the larger of which is 124 *Tauri*, are given in the "Cycle," 240°·8 : 98″·0; 170°·0 : 82″·0 (1835·65).

1879·854	34°·8	145″·73	—	AC.
1879·862	33·8	146·29	—	„
1879·854	175·7	79·00	9	CD.
1879·862	175·2	79·22	—	„

No. 235. *Leporis* 45. β 321.

R.A. 5h 33m 59s
Decl. − 17° 55′

A and B.

1879·131	135°·6	0″·75	7·0...7·2	7 : 50	III.
1881·851	141·8	1·10	6·8...7·5	6 : 05	III.

C and D.

1879·131	358°·6	1″·27	9·0...10·0	7 : 40	III.
1881·151	359·8	1·47	9·0... 9·7	6 : 10	III.

AB and C.

1881·151	135°·9	88″·55	—	6 : 15	III.

A fine group of six stars, two of which are close doubles. The following are the principal measures of these components:

A and B.

1877·33	144°·5	0″·65	De	3 nights.
1879·48	139·2	0·99	β	3 „

C and D.

1877·34	357°·7	1″·26	De	3 nights.
1879·48	359·4	1·49	β	3 „

AB and C

1876·59	136°·0	89″·46	De	2 nights.
1879·18	136·0	88·41	β	3 „

No. 236. ζ *Orionis*. Σ 774.

R.A. 5h 34m 42s
Decl. − 2° 0′

A and B.

1879·909	151°·8	3″·00	—	—	II.
1881·137	151·8	2·73	—	6 : 00	III.
1880·52	151·8	2·87			

A and C.

1879·170	9°·1	57″·10	...9·0	7 : 10	II.
1881·137	9·6	57·34	...9·0	6 : 05	III.
1880·15	9·3	57·22			

No. 237. Σ 775. (8·1 and 8·9.)

R.A. 5h 36m 0s
Decl. + 40° 21′

1878·893	66°·4	22″·75	8·3...8·8	—	II.
1878·906	66·8	22·88	8·0...9·0	3 : 00	III.

No other measures since Struve.

1830·26	66°·8	22″·52	Σ	3 nights.
1878·90	66·6	22·81	β	2 „

No. 238. Σ 782.

R.A. 5h 36m 47s
Decl. − 0° 2′

1878·991	307°·0	39″·38	8·0...8·0	5 20′	II.
1878·994	306·9	39·14	8·0...8·2	5 30	II.
1881·046	308·6	38·93	8·0...8·0	45	III.

The distance is increasing, probably from proper motion.

1831·16	309°·4	36″·16	Σ	3 nights.
1866·66	308·6	38·66	De	3 „
1879·68	307·5	39·15	β	3 „

No. 239.

R.A. 5h 40m 36s
Decl. + 0° 2′

A and C.

1880·022	200°·8	50″·28	9·5...9·5	4 : 25	II.
1880·030	202·2	50·88	9·5...9·5	5 : 15	III.

In the nebula 78 M. The wide pair noted by H. and Smyth, and only measured by the latter. The principal star was found to be a close double (=β 559). The mean of the measures of the distant star is:

1879·13	201°·8	50″·72	β	4 nights.

No. 240. *O Σ* 118.

R.A. 5h 41m 13s
Decl. + 20° 50′

1879·131	314°·7	0″·92	7·0...8·5	8 : 10	III.

Very little change.

No. 241. ν *Aurigæ*. Ḧ v. 90.

R.A. 5h 43m 10s
Decl. + 39° 7′

1879·854	20′ 7	54″·32	...9·5	0 : 15

The only prior measure, except SMYTH's, 201°·9 : 85″·0 (1833·75), is the following:

1783·18	331°·8	53″·72	H	1 night.

This angle, according to the notation then in use, would be 61°·8 *n. p.* Evidently the mistake is in writing *n. p.* for *s. p.* 61°·8 *s. p.* would give 208°·2, agreeing with the later measures.

No. 242. (SMYTH.)

R.A. 5h 44m 22s
Decl. + 32° 31′ ±

1879·854	345°·8	17″·45	9·5...9·5	0 : 30	

The only prior measures are given in the Bedford Catalogue, 357°·0 : 25″·0 (1836·79).

No. 243. Σ 809.

R.A. 5h 44m 33s
Decl. − 1° 28′

1878·991	97°·9	25″·06	7·5...8·0	5 : 35	II.
1879·041	98·7	25·39	8·0...8·7	5 : 20	II.

There is but little change, if any, since STRUVE:

1831·16	101°·2	25″·70	Σ	3 nights.
1879·02	98·3	25·22	β	2 „

No. 244. Σ 807.

R.A. 5h 44m 54s
Decl. + 34° 25′

1878·909	146°·2	2″·32	8·0...9·5	2 : 35	III.

There would seem to be some angular motion, as STRUVE found 139°·7 : 2″·15 (1829·60).

No. 245. *Leporis* 61. β 94.

R.A. 5h 44m 9s
Decl. − 14° 31′

1881·137	182°·5	2″·72	7·0...9·0	6 : 20	II.

There is no doubt but this pair is identical with one discovered by JACOB in 1846. He gave the R.A. about 20m f. this place. That pair has never been seen since, and does not, in fact, exist in the place assigned. We have then the following measures:

1846·4	184°·0	1″·8 ±	J	
1876·16	179·4	2·73	De	4 nights.

No. 246. DE. 10.

R.A. 5h 45m 6s
Decl. + 29° 45′

A and B.

1878·909	167°·1	2″·63	8·3...12·0	3 : 05	II.

A and C (= Σ 808).

1878·909	57°·6	16″·38	...8·5	3 : 15	II.

No change in the STRUVE companion. The prior measures of the close companion discovered by DE. in 1869 agree substantially.

No. 247. *O Σ* 122.

R.A. 5h 47m 41s
Decl. + 36° 55′

1878·840	117°·7	0″·29	7·5...8·0	—	V.

A difficult pair, but the few measures heretofore made do not indicate much change. This was inadvertently placed as new in my Tenth Catalogue.

No. 248. S. 503.

R.A. $5^h\ 49^m\ 10^s$
Decl. $+\ 13°\ 56'$

A and B.

1881·175	98°·6	3″·60	7·0...8·5	6 : 20	II.
1881·186	99·5	3·60	7·0...8·2	8 : 00	II.
1881·195	99·7	3·55	—	7 : 35	III.
1882·120	91·8	3·29	7·8...8·5	—	II.
1882·164	91·5	3·39	—	8 : 00	III.
1882·208	93·8	3·16	—	8 : 45	II.

A and C.

1881·186	158°·1	25″·51	...11·5	8 : 05	II.
1881·195	158·6	25·58	—	7 : 40	III.
1882·120	158·2	25·17	...11·0	—	III.
1882·164	158·9	24·76	—	8 : 05	III.

A and D.

1881·186	335°·4	233″·18	...8.0	8 : 15	II.
1881·195	335·2	233·18	—	7 : 45	III.
1882·120	335·4	233·32	...8·5	—	III.
1882·164	335·4	233·81	—	8 : 10	III.
1882·208	335·2	233·24	—	8 : 50	II.

A very interesting system from the large proper motion of the principal star. It was first observed by South in 1825, since which time it has been entirely overlooked by double-star observers until its re-discovery by De. who noted it as new (A.N. 2045), the description at that time not corresponding at all with that given by South. Upon looking the matter up I found that the two stars were identical. Since then it has been measured by De. and myself on several occasions. I measured a faint star, hitherto unobserved, but like the other companions it is fixed in space. There are many small stars nearer than the distant star measured by South. The proper motion of the large star, as will be seen from the measures of this companion, is almost exactly in that line, so that about 400 years ago these stars must have formed a comparatively close pair. The following are all the measures:

A and B.

1825·07	134°·1	39″·94	S	2 nights.
1873·93	120·1	8·08	De	3 „
1875·21	118·6	7·07	De	3 „
1875·88	117·5	6·72	De	3 „
1881·18	99·3	3·58	β	3 „
1882·16	92·4	3·28	β	3 „
1883·11*	82·6	2·90	β	3 „

A and C.

1878·00	157°·3	28″·09	β	1 night.
1881·19	158·3	25·54	β	2 nights.
1882·14	158·5	24·96	β	2 „
1883·10	158·8	24·61	β	4 „

A and D.

1825·07	337°·3	201″·76	S	3 nights.
1875·21	335·7	230·04	De	3 „
1875·88	335·7	230·84	De	3 „
1881·19	335·3	233·18	β	2 „
1882·16	335·3	233·46	β	3 „
1883·11	334·3	234·09	β	3 „

No. 249. *β Aurigæ.* Ḥ vi. 88.

R.A. $5^h\ 50^m\ 43^s$
Decl. $+\ 44°\ 56'$

1879·862	39°·0	183″·72	...10	1 : 00	II.
1880·046	38·7	184·03	—	7 : 05	II.
1879·95	38·9	183·88			

No. 250. *θ Aurigæ.* *OΣ* 545.

R.A. $5^h\ 51^m\ 32^s$
Decl. $+\ 37°\ 12'$

A and B.

1878·840	2°·7	2″·17	...10·0	—	V.
1878·893	9·7	2·16	...11·0	—	III.

* The individual measures of the last set will be found in the Appendix.

A and C. (H v. 89).

1880·046	292°·7	45″·58	...9·5	8 : 15	II.
1880·142	294·4	45·44	—	8 : 15	II.

A and D. (Sh. 68.)

1880·046	349°·6	127″·10	...8·8	8 : 20	II.

The following are substantially all the measures. The close pair is a beautiful object with even a 6-inch aperture.

1871·42	5°·5	2″·15	O Σ	6 nights	AB.
1875·88	3·2	2·05	De	2 „	
1878·59	5·4	2·08	β	3 „	
1783·20	286°·0	35″·30	H	1 night	AC.
1852·12	290·9	43·29	O Σ		
1875·7	292·4	45·27	De		
1879·41	293·3	45·51	β	3 nights	
1823·17	352°·3	125″·05	Sh	—	AD.
1880·05	349·6	127·10	β	1 night.	

No. 251. *O Σ* 130.

R.A. 5ʰ 59ᵐ 14ˢ
Decl. + 42° 41′

1878·840	190°·4	0·36	7·5...8·5	—	V.

There is very little change in this pair, as O Σ found 183°·9 in 1847.

No. 252. Σ 840.

R.A. 5ʰ 59ᵐ 49ˢ
Decl. + 10° 46′

B and C.

1879·000	175°·8	0″·69	8·7...9·0	6 : 35	V.
1879·028	173·9	0·80	8·5...9·0	5 : 30	III.
1879·01	174·8	0·74	8·6...9·0		

Very slow retrograde motion is probable.

No. 253. Σ 847. (8·5 and 8·8.)

R.A. 6ʰ 1ᵐ 0ˢ
Decl. + 0° 21′

1878·991	261°·7	24″·85	8·5...8·8	5 : 45	II.
1878·994	261·5	24·81	8·5...8·8	5 : 40	II.

No other measures since STRUVE. Evidently unchanged.

1831·84	263°·7	24″·90	Σ	3 nights.
1878·99	261·6	24·83	β	2 „

No. 254. Σ 852. (8·7 and 9·2.)

R.A. 6ʰ 2ᵐ 6ˢ
Decl. + 7° 19′

1878·991	318°·8	8″·99	9·0...9·5	6 : 00	II.
1879·041	317·0	9·02	8·5...9·0	5 : 30	II.

This star is probably D.M. (7°) 1148, in which case the declination should be 7° 14′. No evidence of change.

1830·18	318°·5	9″·19	Σ	2 nights.
1879·02	317·9	9·00	β	2 „

No. 255. Σ 853. (7·9 and 8·2.)

R.A. 6ʰ 2ᵐ 28ˢ
Decl. + 11° 41′

1878·994	349°·0	26″·96	7·8...8·2	5 : 50	II.
1879·044	349·4	27·18	8·0...8·3	5 : 35	II.

The change appears to be due to proper motion.

1830·52	340°·1	24″·06	Σ	3 nights.
1863·41	346·7	26·15	De	3 „
1879·02	349·2	27·07	β	2 „

No. 256. Σ 859. (8·2 and 8·5.)

R.A. 6ʰ 3ᵐ 11ˢ
Decl. + 5° 41′

1879·028	246°·7	34″·42	8·5...8·8	5 : 50	III.
1879·041	246·8	34·38	8·0...8·2	5 : 35	II.

As in the preceding pair, the motion is rectilinear:

1829·70	249°·0	31″·42	Σ	2 nights.
1866·32	248·5	33·93	De	3 „
1879·03	246·7	34·40	β	2 „

No. 257. Σ 862.

R.A. 6h 4m 26s
Decl. + 29° 31′

1878·909	335°·4	6″·26	7·5...11·5	3 : 50	II.

Probably fixed.

No. 258. Σ 867.

R.A. 6h 4m 40s
Decl. + 17° 24′

1881·137	154°·6	2″·11	8·0...8·6	6 : 30	II.

Probably fixed.

No. 259. Σ 871.

R.A. 6h 5m 27s
Decl. − 0° 44′

1879·044	307°·0	7″·70	8·0...8·3	5 : 50	II.
1881·046	307·7	7·24	8·3...8·5	6 : 00	II.
1880·04	307·3	7·47	8·1...8·4		

Probably unchanged.

No. 260. Σ 875.

R.A. 6h 6m 37s
Decl. − 13° 7′

1880·099	330°·7	6″·05	8·5...9·3	5 : 45	II.
1881·046	331·7	5·20	8·5...8·8	6 : 15	II.
1880·56	331·2	5·62	8·5...9·0		

No other measures since STRUVE. Probably fixed.

No. 261. O Σ 135.

R.A. 6h 8m 22s
Decl. + 2° 20′

1879·028 No signs of duplicity, but only moderately good night.

Measured once by O Σ, but later some doubt is expressed as to the existence of the small star. MA. has three doubtful and discordant measures in 1843. DE. found it single in 1866, and I could detect no elongation with the 6-inch in 1873.

No. 262. *Monocerotis* 23. β 567.

(6·8 and 11·0.)

R.A. 6h 9m 34s
Decl. − 4° 53′

1879·107	248°·0	3″·85	6·5...11·5	6 : 50	III.
1881·046	249·9	3·90	6·4...10·0	6 : 25	II.

A mean of all my measures is:

1879·08	249°·5	3″·83	β	4 nights.

No. 263. μ *Geminorum*. (SMYTH.)

R.A. 6h 15m 41s
Decl. + 22° 35′

1879·997	76°·5	72″·94	...11·5	6 : 25	
1880·030	76·7	72·38	—	6 : 00	III.
1880·01	76·6	72·66			

No earlier measures except those in Bedford Catalogue.

No. 264. ζ *Canis Majoris.* (SMYTH.)

R.A. 6h 15m 42s
Decl. − 30° 1′

1879·879	337°·2	174″·15	—	—	II.

Nothing earlier except the measures of the Bedford Catalogue, 338°·0 : 167″·0 (1833·81).

No. 265. *O Σ* 138.

R.A. 6h 15m 51s
Decl. + 27° 11′

1879·000 No trace of any companion.

The duplicity of this star is very doubtful, to say the least.

No. 266. 5 *Lyncis.* S. 514.

R.A. 6h 16m 20s
Decl. + 58° 29′

A and B.

1879·862	139°·1	30″·34	...10·5	1 : 20	II.

A and C.

1879·862	272°·5	95″·93	...8·5	1 : 25	II.

The only earlier measures of B are by SMYTH, 130°·0 : 25″·0 (1833·77). There appears to be no change in the distant star, as S. found 272°·1 : 95″·44 (1825·06).

No. 267. β *Canis Majoris.* (SMYTH.)

R.A. 6h 17m 24s
Decl. − 17° 54′

1879·879	339°·0	184″·63	...8.0	—	II.
1879·909	339·1	185·29	...8·9	—	II.
1879·89	339·0	184·96			

SMYTH gives, 339°·0 : 104″·0 (1833·76).

No. 268. S. 518.

R.A. 6h 18m 59s
Decl. − 16° 10′

1878·985	86°·2	16″·43	7·0...8·0	—	II.
1880·079	86·9	16·38	6·8...8·0	4 : 30	II.
1881·137	87·4	15·92	7·9...8·6	: 05	II.

The following are all the measures:

1783·06	87°·6	17·98	♅	1 night.
1825·03	89·5	15·60	S	2 nights.
1880·06	86·8	16·24		3 „

No. 269. Σ 907.

R.A. 6h 20m 26s
Decl. + 30° 30′

1878·909	302°·1	12″·00	9·0...9·5	4 : 05	II.
1881·151	302·3	11·87	8·9...9·2	7 : 05	II.
1880·03	302·2	11·94	9·0...9·3		

Relatively fixed.

No. 270. 10 *Monocerotis.* (SMYTH.)

R.A. 6h 22m 3s
Decl. − 4° 41′

A and B.

1879·879	256°·4	76″·99	...9·0	—	II.
1879·909	256·8	76·94	...	—	II.
1879·89	256·6	76·96			

A and C.

1879·879	231°·0	80·6″4	...9·0	—	II.
1879·909	—	81·18	...	—	II.
1879·89	231·0	80·91			

It is impossible to tell which of these stars SMYTH observed in finding 225°·0 : 72″·0 (1832·99).

No. 271. *O Σ* 146 *rej.*

R.A. 6h 25m 40s
Decl. + 11° 46′

1878·991	141°·2	32″·72	6·0...9·0	6 : 15	II.

The only other measures are:

1867·000	142°·6	33″·36	De	3 nights.

No. 272. *O Σ* 147.

R.A. 6h 26m 6s
Decl. + 38° 10′

A and B.

1882·120	73°·2	43″·76	7·5...8·5	8 : 10	III.

A and CD.

1882·120	116°·0	46″·11	...9·0	8 : 05	III.

C and D.

1878·840	295°·6	0″·51	...9·5	—	IV.
1881·120	117·5	0·59	...9·0	8 : 00	III.
1879·98	116·5	0·55	...9·2		

The close pair is difficult. The following are all the prior measures:

1849·76	73°·4	42″·93	O Σ	2 nights	AB.
1849·76	116·1	46·09	O Σ	2 „	AC.
1849·76	114·7	0·55	O Σ	2 „	CD.

No. 272*a*. *γ Geminorum.* (SMYTH.)

R.A. 6h 28m 28s
Decl. + 16° 30′

A and B.

1880·030	294°·7	133″·04	...11·0	6 : 20	III.

A and C.

1880·030	335°·5	141″·74	...10·5	6 : 25	III.

The "Cycle" gives, 335°·0 : 75″·0 (1830·80).

No. 273. *O Σ* 150.

R.A. 6h 30m 49s
Decl. + 42° 7′

1878·840	353°·5	0″·28	7·8...8·0	—	V.

A difficult pair, but apparently unchanged, as O Σ found 351°·1 : 0″·34 (1847·27).

No. 274. Σ 954.

R.A. 6h 34m 34s
Decl. + 9° 35′

1878·991	151°·6	12″·92	7·5...9·0	6 : 20	II.
1881·085	153·4	12·73	8·0...9·7	7 : 20	II.
1882·162	153·7	12·88	—	7 : 45	III.

Undoubtedly fixed.

1829·88	153°·5	12″·72	Σ	3 nights.
1880·78	152·9	12·84	β	3 „

No. 275. Σ 955.

R.A. 6h 35m 24s
Decl. − 7° 53′

1879·102	269°·1	0″·84	8·0...9·0	6 : 50	III.

Change doubtful.

No. 276. *O Σ* 154. (7·1 and 9·0.)

R.A. 6h 35m 52s
Decl. + 40° 45′

1878·900	128°·6	27″·45	7·2...8·5	2 : 25	II.
1878·906	128·7	27·92	7·0...9·5	3 : 15	II.

The change is probably in consequence of proper motion.

1848·76	136°·3	30″·28	O Σ	2 nights.
1867·91	131·7	28·76	De	3 „
1878·62	128·8	27·71	β	3 „

No. 277. β 19.

R.A. 6h 36m 36s
Decl. − 15° 53′

1880·219	166°·9	3″·40	7·8...8·8	7 : 10	II.
1881·085	166·6	3·78	7·5...9·0	7 : 00	II.
1881·134	164·8	3·76	7·5...9·0	7 : 15	II.

For comparison we have:

1876·26	165°·0	3″·52	De	3 nights.
1880·81	166·1	3·65	β	3 „

No. 278. 30 *Geminorum.* (Edgecomb.)

R.A. 6h 37m 13s
Decl. + 13° 21′

1879·028	184°·3	28″·07	6·0...13·0	6 : 30	III.
1879·041	184·4	28·38	6·0...12·5	6 : 20	II.
1879·107	183·6	27·70	6·0...12·5	7 : 10	III.
1879·06	184·1	28·05	6·0...12·7		

Discovered by Edgecomb with 9·4 inch 1878. No other measures.

No. 279. *Sirius.* A G.C. 1.

R.A. 6h 39m 53s
Decl. − 16° 33′

1878·955	51°·0	10″·28	—	—	III.
1878·980	50·9	—	—	5 : 00	II.
1878·985	49·8	10·86	—	5 : 20	II.
1879·000	51·0	10·72	—	7 : 15	III.
1879·028	50·8	10·50	—	6 : 45	III.
1879·041	50·7	10·36	—	5 : 50	II.
1879·102	51·0	10·41	—	6 : 30	IV.
1879·104	50·7	10·33	—	6 : 20	III.
1879·128	49·7	10·16	—	6 : 10	III.
1879·131	51·1	10·32	—	8 : 20	III.
1879·879	47°·6	10″·18	—	7 : 30	III.
1879·997	47·9	9·85	—	6 : 10	II.
1880·030	47·6	—	—	5 : 20	III.
1880·063	49·1	9·99	—	6 : 30	II.
1880·162	47·4	10·11	—	7 : 30	II.
1880·173	48·2	10·05	—	7 : 15	II.
1880·181	50·5	10·18	—	—	II.
1880·184	48·5	9·93	—	8 : 30	II.
1880·189	47·6	9·66	—	7 : 10	II.
1880·211	48·6	10·13	—	7 : 30	II.
1880·214	48·4	9·97	—	6 : 40	II.
1880·909	46·9	9·87	—	5 : 30	II.
1880·958	46·4	9·77	—	6 : 30	III.
1881·044	46·6	9·87	—	5 : 30	III.
1881·046	46·5	9·78	—	6 : 40	III.
1881·134	45·7	9·97	—	7 : 25	III
1881·137	45·8	—	—	7 : 30	II.
1881·151	46·1	9·47	—	7 : 10	III.
1881·175	46·3	9·72	—	6 : 35	III.
1881·184	45·7	9·68	—	7 : 15	III.
1881·835	42·6	9·72	—	4 : 45	IV.
1881·840	43·9	9·56	—	4 : 15	II.
1881·843	43·6	9·20	—	4 : 35	II.
1881·859	43·1	8·87	—	4 : 00	II.
1881·865	43·2	9·62	—	4 : 25	VI.
1882·085	47·4	9·48	—	7 : 00	III.
1882·088	44·4	9·64	—	6 : 00	III.
1882·102	43·6	9·11	—	—	III.
1882·104	43·4	9·35	—	8 : 15	III.
1882·145	41·7	9·25	—	6 : 30	III.
1882·148	43·0	9·36	—	6 : 00	III.

The first five measures of the last series were made at the Lick Observatory on Mount Hamilton. The following are the mean results of all my measures, including the first set already published in detail:

1877.97	52°·4	10″·83	8 nights.
1879.05	50·7	10·44	10 „
1880·11	48·3	10·00	11 „
1881·07	46·3	9·77	8 „
1881·99	43·6	9·38	11 „
1883·10*	40·1	9·05	10 „

* For details of this set of measures see Appendix.

No. 280. Σ 965.

R.A. 6h 40m 36s
Decl. + 11° 3′

A and B.

1879·142	348°·4	5″·97	8·5... 9·0	6 : 30	II.
1879·178	348·6	5·74	9·0...10·0	6 : 20	II.

A and C.

1879·142	320°·7	13″·99	...13·0	6 : 35	II.
1879·178	323·8	14·71	...12·5	6 : 25	II.
1879·16	322·2	14·35			

A and D.

1879·142	67°·1	45″·66	... 8·7	6 : 40	II.
1879·178	67·1	44·90	... 9·5	6 : 25	II.

The faint star C was not seen by STRUVE, and is now observed for the first time. With the exception of a single measure of AB by MA., the STRUVE stars have not been measured in the last half-century. There would seem to be some relative motion:

1829·86	351°·8	5″·49	Σ	3 nights.
1879·16	348·5	5·85	β	2 „
1829·86	70·9	47·02	Σ	3 „
1879·16	67·1	45·28	β	2 „

No. 281. *O* Σ 157.

R.A. 6h 41m 37s
Decl. + 0° 28′

1879·102	357°·2	0″·64	7·8...8·0	7 : 00	IV.

Very little change.

No. 282. β 20. (7·8 and 10·8.)

R.A. 6h 43m 26s
Decl. − 16° 4′

1879·184	37°·8	2″·80	7·5...11·5	6 : 40	II.
1880·063	32·9	3·22	8·0...11·0	6 : 40	II.
1880·162	32·9	2·88	8·0...10·0	7 : 40	II.
1881·046	34·7	3·06	—	6 : 45	III.

Near *Sirius*, a short distance *n. f.*

1876·42	29°·8	3″·20	De	4 nights.
1880·11	34·6	2·99	β	4 „

No. 283. *Canis Maj.* 89. A.C. 4.

R.A. 6h 43m 32s
Decl. − 15° 1′

1878·028	288°·9	0″·93	6·5...8·0	6 : 55	III.

No evidence of change to this time.

No. 284. *O* Σ 158 *rej.*

R.A. 6h 44m 0s
Decl. + 51° 40′

1878·906	304°·8	16″·34	7·0...12·0	3 : 25	II.

Probably unchanged, from DE. 304°·4 : 16″·83 (1868·3).

No. 285. H. 740.

R.A. 6h 45m 38s
Decl. + 0° 36′

1879·997	6°·7	20″·69	8·0... 8·5	6 : 40	
1880·063	8·0	20·91	8·0... 8·3	7 : 00	II.
1881·145	8·6	21·08	8·5... 8·8	7 : 30	II.
1881·151	8·6	20·69	8·0... 8·5	7 : 20	II.
1880·59	8·0	20·84	8·1... 8·5		

B and C.

1880·063	281°·9	8″·67	...12·5	7 : 05	II.
1881·151	285·8	7·69	...12·5	7 : 15	II.
1880·60	283·8	8·18	...12·5		

The third star has not been observed before.

No. 286. 15 *Lyncis.* O Σ 159.

R.A. 6h 46m 54s
Decl. + 58° 35′

A and B.

1878·840	1°·1	0″·62	5·0...7·0	—	V.

A and C.

1878·840	342°·5	23″·52	...13·0	—	V.

There is an error in the printing of the angle of C in my prior measures. It should read 341°·4 instead of 31°·4. The two measures of C give 342°·0 : 23″·58 (1878.50).

No. 287. O Σ 160.

R.A. 6h 47m 11s
Decl. + 21° 19′

1879·028	171°·4	1″·34	6·5...11·0	7 : 05	III.

There may be a little change in this pair. The following are all the measures:

1843·22	154°·7	1″·0	Ma	2 nights.
1848·23	167·1	1·26	O Σ	3 „
1878·59	172·8	1·38	β	2 „

No. 288. β 327.

R.A. 6h 52m 28s
Decl. − 2° 52′

A and B.

1881·046	96°·1	0″·75	7·5... 7·5	7 : 00	III.

AB and C.

1880·214	99°·9	13″·33	...11·5	7 : 00	II.
1881·046	100·6	13·09	...11·0	7 : 05	III.
1880·63	100·2	13·21	...11·2		

The only other complete measures are:

1876·80	100°·8	0″·96	De	2 nights.
1876·80	102·6	13·22	De	2 „

No. 289. Σ 1004. (8·0 and 9·1.)

R.A. 6h 52m 50s
Decl. − 11° 16′

1880·063	87°·7	19″·09	8·0...9·0	7 : 10	II.
1881·046	87·5	18·98	8·0...9·0	7 : 15	II.
1881·085	87·6	19·28	8·0...9·2	7 : 30	II.

The following are all the measures:

1830·16	87°·5	18″·43	Σ	2 nights.
1863·16	89·4	19·61	En	2 „
1880·73	87·6	19·12	β	3 „

No. 290. 41 *Geminorum.* O Σ 162 *rej.*

R.A. 6h 52m 57s
Decl. + 16° 7′

1879·175	155°·8	21″·76	6·5...11·5	6 : 25	II.
1879·178	154·0	20·94	7·0...11·8	7 : 00	II.
1881·046	155·0	21·13	6·7...11·5	7 : 25	II.

O Σ did not measure this, and De. was unable to see the companion in 1866. The following are all the measures, which would seem to indicate considerable change if the early distance is correct:

1843·00	164°·9	13″·5	Ma	1 night.
1879·15	154·9	21·16	β	5 nights.

No. 291. β 100.

R.A. 6h 54m 13s
Decl. + 12° 34′

1880·214	262°·1	3″·34	8·0...10·5	7 : 15	II.
1881·046	262·0	2·94	7·0... 9·5	7 : 35	II.

The following are all the measures of this pair:

1875·36	258°·1	3″·27	De	3 nights.
1880·63	262·0	3·14	β	2 „

No. 292. *O Σ* 163.

R.A. 6h 54m 28s
Decl. + 11° 57′

A and B.

1879·028	322°·7	0″·54	7·0...9·0	7 : 15	IV.

A and C.

1879·028	158°·5	14″·18	...12·0	7 : 25	IV.

The small star C is new. The close pair appears to be unchanged.

1848·57	320°·7	0″·57	O Σ	3 nights.
1867·40	323·4	0·5	De	3 „

No. 293. *β* 572. (7·2 and 11·2.)

R.A. 6h 55m 44s
Decl. − 20° 30′

1879·128	143°·6	5″·18	7·0...11·5	6 : 40	III.
1881·175	144·5	5·00	7·5...11·0	7 : 15	II.

The mean of my measures is:

1879·39	143°·9	5″·07	*β*	3 nights.

No. 294. *β* 573.

R.A. 6h 56m 11s
Decl. − 10° 42′

1879·128	248°·6	0″·75	8·0...8·2	6 : 30	III.

The only other measures are:

1878·17	244°·9	0″·8 ±	Cin	2 nights.
1878·21	246·9	0·81	De	1 night.

No. 295. *ζ Geminorum.* SH. 77.

R.A. 6h 56m 59s
Decl. + 20° 45′

A and B.

1879·997	83°·4	87″·20			
1880·030	83·7	87·24	...10·5	6 : 30	III.

A and C.

1879·997	351°·6	93″·67			

The only prior measures of B are by SMYTH, 85°·0 : 65″·0 (1831·81). There is not much change in the distant companion:

1821·22	355°·4	91″·03	Sh	1 night.
1874·06	351·7	93·54	De	2 nights.

No. 296. Σ 1016. (7·9 and 9·2.)

R.A. 6h 59m 1s
Decl. − 11° 21′

1880·063	150°·9	5″·25	8·0...9·0	7 : 30	II.
1881·085	150·8	5·16	7·8...9·5	7 : 40	II.
1881·137	150·7	5·34	8·0...9·0	7 : 50	II.

Probably unchanged. There is a more distant star in the same quadrant:

1831·68	152°·4	5″·15	Σ	4 nights.
1880·76	150·8	5·25	*β*	3 „

No. 297. *Canis Majoris* 136. DE. 12.

R.A. 7h 0m 10s
Decl. − 10° 29′

A and B.

1881·145	281°·9	6″·14	7·5...11·0	7 : 45	II.

B is a closer companion to the principal star of Σ 1019, discovered by DE. in 1867. There is no change in C.

1867·18	278°·7	6″·12	De	2 nights.

No. 298. *Canis Majoris* 139. *β* 328.

R.A. 7h 1m 3s
Decl. − 11° 7′

A and B.

1879·128	117°·8	0″·48	7·0... 8·5	6 : 50	IV.

AB and C (=Σ 1026 *rej.*).

1879·128	349°·9	17″·85	...9·0	6 : 55 IV.

The principal star of STRUVE's rejected pair was found to be a close double with the 6-inch, 1875.

The only other measures are:

1875·95	128°·4	0″·3	De	4 nights.
1878·17	127·8	—	Cin	1 night.

No. 299. Σ 1031.

R.A. 7ʰ 3ᵐ 5ˢ
Decl. − 13° 48′

A and B.

1879·184	249°·2	3″·70	8·5... 9·0	7 : 15	II.
1881·085	249·1		Clouded	7 : 50	II.

A and C.

1879·184	349°·7	12″·02	...12·0	7 : 25	II.

The faint star was noted by H., and angle given 351°·8 (1837·0). The distance has not been measured before. There is probably no change in AB.

1831·16	251°·6	3″·80	Σ	3 nights.
1879·48	248·9	3·51	β	3 „

No. 300. δ *Canis Majoris.*

R.A. 7ʰ 3ᵐ 30ˢ
Decl. − 26° 12′

1879·985	224°·0	266″·88
1879·997	224·1	265·97

A distant star observed by SMYTH. His distance is about 100″ too small. Many faint stars nearer.

No. 301. *Canis Majoris* 146. β 329.

R.A. 7ʰ 4ᵐ 8ˢ
Decl. − 16° 2′

1880·214	99°·0	30″·00	6·3...11·5	7 : 30	II.
1881·137	96·3	29·05	6·5...12·0	8 : 00	II.
1880·67	97·6	29·52	6·4...11·7		

No other measures.

No. 302. β 195.

R.A. 7ʰ 6ᵐ 27ˢ
Decl. − 5° 14′

1880·219	189°·7	3″·33	9·5...11·0	7 : 30	II.

DE. gives from a single measure 186°·7 : 3″·52 (1876·83).

No. 303. Σ 1049.

R.A. 7ʰ 7ᵐ 57ˢ
Decl. − 8° 43′

1880·063	42°·9	3″·61	8·5... 9·0	7 : 40	II.

This star has moved about 8° in angle since Σ.

No. 304. Σ 1058.

R.A. 7ʰ 10ᵐ 17ˢ
Decl. + 9° 37′

1879·184	281°·0	22″·84	8·0...11·0	7 : 45	II.
1879·200	281·0	22·32	8·5...11·0	7 : 15	II.
1879·997	279·4	22·47	8·5...10·5	—	II.
1881·164	281·4	22·58	8·5...10·0	8 : 25	II.

The only prior measure since Σ is a single observation by MA. If the companion is not variable, which is not probable, the attempts to find this star heretofore have been singularly unfortunate. DE. could not see it in 1865, and I failed to find it with the 6-inch, 1874–5, and in

1878 with this telescope. The real explanation is probably that the object is so insignificant, attention was not directed to it. There seems to be but little, if any, change.

1832·19	282°·7	23″·78	Σ	2 nights.
1844·13	283·0	22·47	Ma	1 night.
1879·87	280·7	22·55	β	4 nights.

No. 305. *O Σ* 170.

R.A. 7h 11m 5s
Decl. + 9° 31′

1879·200	112°·9	1″·28	7·5... 7·5	7 : 35	III.

Slow retrograde motion.

No. 306. 30 *Canis Majoris.* H. 3948.

R.A. 7h 13m 44s
Decl. − 24° 44′

A and B.

1880·189	91°·5	7″·72	6·0...10·5	7 : 00	II.
1880·211	90·4	7·97	6·0...10·5	7 : 40	II.
1880·20	90·0	7·84	6·0...10·5		

A and C.

1880·189	81°·0	14″·30	...11·5	7 : 05	II.
1880·211	79·6	14·35	...11·0	7 : 45	II.
1880·20	80·3	14·32	...11·2		

A and D. (Smyth.)

1880·189	77°·9	84″·40	... 8·5	7 : 10	II.
1880·211	78·0	84·46	... 9·0	7 : 50	II.
1880·20	78·0	84·43	... 8·7		

All the measures of the two companions discovered by H. are of recent date. H. gave the angles 85°·8 and 73°·3 respectively. Smyth only saw a distant star, one of twenty or more in the field, the measures of which are approximately correct.

No. 307. Σ 1079.

R.A. 7h 16m 30s
Decl. + 38° 3′

A and B.

1880·046	330°·6	5″·48	8·5... 9·0	9 : 00	II.
1880·060	333·4	5·69	8·0... 8·8	7 : 30	III.

A and C.

1880·046	252°·2	220″ ±	—	9 : 05	II.

C and D.

1880·046	63°·2	1″·58	10·0...10·0	9 : 10	II.
1880·060	66·1	1·95	9·0... 9·0	7 : 45	III.
1880·05	64·6	1·76	9·5... 9·5		

CD is a new pair of small stars in the same field. There is probably no change in Struve's pair:

1830·90	330°·7	5″·91	Σ	3 nights.
1880·05	332·0	5·59	β	2 „

No. 308. Σ 1082.

R.A. 7h 17m 11s
Decl. + 10° 56′

A and B.

1880·219	326°·7	20″·09	8·5...9·0	7 : 50	II.

A and C.

1880·219	18°·4	—	...13·0	7 : 55	II.

B and C.

1880·219	100°·0	—	—	8 : 00	II.

No measures of B since Σ, but probably unchanged. C is a new component.

No. 309. *η Canis Majoris.* (Smyth.)

R.A. 7h 19m 21s
Decl. − 29° 4′

1879·985	284°·9	178″·67			
1880·030	285·0	178·63	...8·0	7 : 00	II.
1880·00	285·0	178·65	...8·0		

The only other measures are those of the Bedford Catalogue, 285°·0 : 169″·0 (1833·82).

No. 310. *β Canis Minoris.*

R.A. 7ʰ 20ᵐ 39ˢ
Decl. + 8° 32′

A and B.

1880·162	82°·3	47″·77	...13·0	—	II.

A and C.

1879·985	22°·7	97″·02

A and D.

1879·985	76°·8	123″·95
1879·997	76·6	122·35

A and E.

1879·985	309°·8	139″·09	...10·0	
1879·997	310·1	138·87		

SMYTH attempted to measure two companions, giving for one, 80°·0 : 35″·0 (1831·84), and for the other, 312°·0 : 105″·0 (1831·84). The last of these is undoubtedly the star I have designated as E. It is impossible to say what the first is, but it is certainly not B, as that is an excessively faint star, far beyond the reach of SMYTH's telescope, and would have been called by HERSCHEL of at least 20 mag. It is probably D of the foregoing measures. There are other faint stars nearer than D besides those measured.

No. 311. Σ 1093.

R.A. 7ʰ 21ᵐ 10ˢ
Decl. + 50° 14′

1878·840	130°·0	0″·07	8·0... 8·0	—	V.

Binary, in slow direct motion. The change since STRUVE is about 33°.

No. 312. β 22. (8·2 and 10·4.)

R.A. 7ʰ 25ᵐ 30ˢ
Decl. + 33° 7′

1880·145	153°·3	6″·00	8·0...10·5	9 : 40	II.
1880·151	153·9	6·09	8·0...10·5	8 : 00	II.
1880·219	149·1	6·24	8·5...10·0	8 : 05	II.
1882·219	150·6	6·25	8·5...10·8	8 : 40	III.

The difference in distance between the measures of DEMBOWSKI and my own would seem to be too great for the ordinary errors of observation, as the pair is not a difficult one.

1875·32	149°·5	6″·48	De	4 nights.
1880·68	151·7	6·14	β	4 „

No. 313. Σ 1108. (7·3 and 8·9)

R.A. 7ʰ 25ᵐ 39ˢ
Decl. + 23° 9′

1879·233	179°·5	11″·53	7·0...9·0	7 : 35	II.
1881·145	179·2	11·61	7·6...8·7	8 : 00	II.

Evidently unchanged.

1827·27	179°·1	11″·54	Σ	2 nights.
1880·19	179·3	11·57	β	2 „

No. 314. β 579. (ACD = *O Σ* 173 *rej.*)

R.A. 7ʰ 26ᵐ 40ˢ
Decl. + 33° 23′

A and C.

1880·145	232°·8	19″·14	7·5...10·8	9 : 20	II.
1880·151	235·1	18·74	7·8...11·0	8 : 15	II.
1880·15	234·0	18·94	7·7...10·9		

A and D.

1880·145	349°·7	43″·06	... 8·5	9 : 25	II.

The principal star is a very difficult double, close and unequal. It was suspected with the 6-inch, and verified with the 18½-inch. My former measure of C is only a single distance, and by an error given 1″ too small.

No. 315. 70 *Geminorum.* β 200.

R.A. 7h 30m 41s
Decl. + 35° 19′

A and B.

1880·145	100°·7	160″·21	—	9 : 00	II.
1880·151	100·8	160·84	—	8 : 35	II.

B and C.

1880·046	242°·8	1″·54	—	7 : 30	II.
1880·145	240·6	1·43	9·0...10·0	8 : 50	II.
1880·151	242·1	1·29	—	8 : 30	II.

B and D.

1880·046	205°·6	16″·39	...13·0	7 : 35	II.
1880·145	207·6	18·01	...13·0	8 : 55	II.
1880·09	206·6	17·20	...13·0		

The following are all the measures of B and C.

1875·02	98°·7	162″·02	De	2 nights	AB.
1880·15	100·7	160·47	β	2 „	
1876·02	241·8	1·49	De	2 „	BC.
1880·11	241·8	1·42	β	3 „	

No. 316. *Procyon.*

R.A. 7h 33m 1s
Decl. + 5° 33′

1879·175	319°·3	44″·95	1·0...12·13	6 : 50	II.
1879·225	318·4	44·64	...12·13	8 : 15	III.
1880·184	322·2	44·75	...12·5	8 : 40	II.
1880·189	323·0	44·83	—	7 : 30	II.
1882·164	323·2	45·56	—	8 : 50	III.
1882·219	323·7	45·31	—	8 : 55	III.
1882·233	323·9	45·23	—	8 : 40	III.

I have examined *Procyon* carefully with this instrument many times, but have never seen or even suspected any nearer companion than one measured above, which was discovered by LAMONT about 1836. The measures of this star are:

1836·7	262°·3	56″·59	Lamont	
1863·21	294·9	45·8	Romberg	2 nights.
1874·00	311·8	44·59	Newcomb	1 night.
1877·88	317·3	44·62	β	2 nights.
1879·20	318·8	44·80	β	2 „
1880·18	322·6	44·74	β	2 „
1882·20	323·6	45·37	β	3 „

No. 317. (BIRD.) (9 1, 9·2, and 13.)

R.A. 7h 33m 24s
Decl. + 5° 33′

A and B.

1879·028	190°·7	0″·81	9·4...9·5	7 : 40	IV.
1879·175	184·6	0·91	9·0...9·0	7 : 00	III.
1881·046	191·3	0·76	—	7 : 50	III.
1882·233	191·3	0·79	9·0...9·0	8 : 55	III.

AB and C.

1880·184	335°·2	36″·53	...13·0	8 : 50	II.
1882·219	334·7	35·49	...13·0	9 : 00	III.
1882·233	335·6	35·70	...13·0	8 : 45	III.
1881·54	335·2	35·91			

In the field with *Procyon*; discovered by BIRD. It was also discovered independently by DE. This star has often been connected by micrometrical measures with *Procyon*, and was for some time an object of interest, by reason of the erroneous

measures of SMYTH, which seemed to show a great change in distance, or the disappearance of a star. When the true value of the 'Cycle' observations of stars of this class came to be understood, the mystery was solved. This star in 1877 was 346″ from *Procyon* in the direction of 80°·5. The following are all the measures of the close pair:

1872·90	182°·6	0″·79	De	5 nights.
1880·39	189·5	0·82	β	4 „

No. 317*a*. Σ 1126.

R.A. 7h 33m 44s
Decl. + 5° 30′

1879·241	142°·7	1″·17	—	7 : 20	III.

No. 318. κ *Geminorum*. OΣ 179.

R.A. 7h 37m 12s
Decl. + 24° 41′

1879·102	234°·1	6″·27	—	8 : 00	IV.

No. 319. *Pollux*. β 580.

R.A. 7h 38m 1s
Decl. + 28° 19′

A and B.

1880·219	275°·3	41″·39	...13·5	8 : 20	V.

A and C.

1879·233	71°·2	174″·70	—	7 : 55	II.

A and D.

1879·241	50°·0	206″·30	...9·5	—	III.

A and E.

1879·241	75°·3	229″·24	...9·0	—	III.

The small star C is a close and difficult pair, 132°·6 : 1″·40 (1878·15). B is an exceedingly faint star. My previous measure is only a single distance. The change in the positions of the old companions C, D, and E, is the result of the proper motion of the principal star.

No. 320. A.G.C. 2.

R.A. 7h 40m 30s
Decl. + 28° 59′

1879·028	114°·9	0″·81	8·0...11·0	8 : 00	III.

Discovered by Mr. ALVAN G. CLARK with the Vienna 12-inch. No other measures.

No. 321. Σ 1143.

R.A. 7h 41m 41s
Decl. + 5° 42′

STRUVE measured this star once, 152°·0 : 9″·34 (1825·21), but on two subsequent occasions was unable to find it, and it has never been seen since. DE. looked for it 1864–5, and in 1874–5 I tried in vain to find it with the 6-inch. In 1878, and again in 1881, I made a very careful search with the 18½-inch not only in the place given by STRUVE, but for a considerable distance in all directions. The failure of STRUVE to find shortly after his first measure shows conclusively that there is some error in the place. I looked south of the equator, assuming the declination might have been south instead of north, but found no pair of this description. I also tried some places with an even number of minutes of more and less R.A., and have examined the double-

star catalogues for any such pair in other hours of R.A. and different degrees of declination, but without success thus far. It will probably be found some time, as there is scarcely a possibility of the star or companion disappearing, and no rapid orbital motion has ever been detected in a pair of this class. There is certainly an error of some kind in the place given by STRUVE.

No. 322. Σ 1147.

R.A. 7h 43m 5s
Decl. + 24° 50′

1880·145	164°·0	2″·08	8·5...8·5	10 : 00	II.
1881·145	166·1	2·20	8 5...8·5	8 : 20	II.

No one else except MA. has measured this since STRUVE. There seems to be some change in the distance:

1830·73	162°·3	2″·46	Σ	4 nights.
1880·54	165·0	2·14	β	2 „

No. 323. 9 *Argus*. β 101.

R.A. 7h 46m 13s
Decl. − 13° 35′

1879·128	303°·0	0″·51	5·0...7·0	7 : 50	IV.

This rather difficult pair, which was discovered with the 6-inch, 1873, seems from the following measures to be moving:

1875·co	289°·4	0″·51	De	4 nights.
1878·47	302·6	0·45	Cin	4 „
1878·52	301·8	0·46	β	3 „
1879·68	306·2	0·38	III	2 „

No. 324. *O* Σ 182.

R.A. 7h 46m 24s
Decl. + 3° 42′

1879·000	42°·6	0″·99	7·5...7·5	7 : 40	III.
1881·184	37·7	0·99	8·0...8·0	7 : 45	III.
1880·09	40·1	0·99	7·7...7·7		

Very little change in this pair since the first measures.

No. 325. Σ 1156 (=Σ 1163).

R.A. 7h 48m 47s
Decl. + 24° 59′

1880·145	160°·0	18″·64	8·0...9·3	10 : 15	II.

This pair is entered twice in *Mensuræ Micometricæ*. There is an error of 2m R.A. in the place given of Σ 1163. The following are all the prior measures:

1827·38	158°·5	18″·64	Σ	2 nights.	As Σ 1156.
1828·28	160·7	18·35	Σ	2 „	As Σ 1163.
1867·8	159·7	18·88	De	2 „	

No. 326. Σ 1168.

R.A. 7h 52m 22s
Decl. + 5° 57′

1879·000	217°·8	5″·86	8·0...12·0	7 : 50	III.
1881·184	218·7	6·02	7·8...11·3	7 : 55	II.

Probably unchanged. No other measures since Σ:

1831·22	214°·7	5″·86	Σ	3 nights.
1880·09	218·2	5·94	β	2 „

No. 327. Σ 1165.

R.A. 7h 52m 41s
Decl. + 54° 57′

1878·840	273°·7	0″·68	8·3...9·5	—	V.

There may be a slight advance in the angle.

No. 328. Σ 1171.

R.A. 7h 53m 51s
Decl. + 23° 55′

1880·145	331°·1	2″·48	—	10:25	II.

No. 329. Σ 1172.

R.A. 7h 55m 11s
Decl. + 55° 5′

1878·840	245°·9	1″·74	7·5...10·0	—	V.

No other measures since Σ, except a single observation by MA. Probably unchanged.

No. 330. ζ *Cancri.* Σ 1196.

R.A. 8h 5m 20s
Decl. + 18° 1′

A and B.

1880·266	84°·2	0″·77	—	8:20	V.
1880·269	83·5	1·01	—	8:30	III.
1880·277	84·7	0·70	—	8:45	IV.
1880·299	88·1	0·54	—	9:30	V.
1880·315	85·6	0·64	—	9:30	V.
1880·320	88·0	0·59	—	9:45	V.
1880·29	85·2	0·73			

No. 331. Σ 1202.

R.A. 8h 6m 59s
Decl. + 11° 13′

1882·195	327°·3	2″·54	8·0...9·5	9:00	III.

No. 332. β 204.

R.A. 8h 7m 2s
Decl. + 10° 45′

1879·128	304°·1	0″·99	7·5...9·0	8:00	II.

DE. by four observations finds 302°·1 : 1″·06 (1875·89).

No. 333. H. 2435.

R.A. 8h 7m 45s
Decl. − 5° 24′

1880·030	206°·3	6″·91	9·0...9·2	7:35	II.
1881·151	207·6	7·09	9·5...9·5	8:45	II.
1880·59	207·0	7·00	9·2...9·3		

H. gives the angle 202°·2; no other measures.

No. 334. Σ 1216.

R.A. 8h 15m 15s
Decl. − 1° 13′

1879·206	161°·0	0″·31	7·0...7·3	8:20	V.
1879·225	160·6	0·42	7·0...7·5	8:55	V.
1879·21	160·8	0·37	7·0...7·4		

Binary. The motion in angle since 1825 is about 50°.

No. 335. Σ 1220.

R.A. 8h 18m 9s
Decl. + 24° 44′

1880·145	211°·5	29″·62	8·0...8·5	—	II
1881·151	210·7	29·63	8·3...8·8	8:55	II.

No other measures since STRUVE:

1828·77	208°·3	29″·89	Σ	2 nights.
1880·64	211·1	29·63	β	2 „

No. 336. *Cancri* 64. Ll v. 109.

R.A. 8h 19m 29s
Decl. + 7° 57′

1880·030	342°·2	31″·97	6·0...10·0	7 : 50	II.
1881·186	343·8	31·75	5·8...10·0	8 : 25	II.

No other measures since Hj, with the exception of Smyth's.

1783·14	325°·0	35″·40	Hj I	1 night.
1880·61	343·0	31·86	β	2 nights.

No. 337. Σ 1233.

R.A. 8h 22m 26s
Decl. − 2° 7′

1879·192	330°·1	18″·21	6·5...11·0	9 : 55	II.
1880·030	331·1	17·95	6·8...10·0	8 : 05	II.
1881·151	330·7	18·01	7·0...9·0	9 : 05	II.

The measures of Smyth showed considerable change in both angle and distance, and hence it was observed here, there being no measures on record since those given in the Bedford Catalogue. The components are evidently fixed:

1828·71	331°·5	18″·20	Σ	2 nights.
1879·62	330·6	18·08	β	4 „

No. 338. *θ Cancri.* Hj v. 59.

R.A. 8h 24m 45s
Decl. + 18° 30′

1879·255	59°·9	60″·70	...10·0	8 : 20	II.
1880·030	59·5	60·72	...10·5	8 : 15	II.
1881·151	60·5	61·10	5·5...10·8	9 : 10	II.

The following are all the measures of this wide pair with the exception of Smyth's, 62°·4 : 65″·0 (1833·31):

1783·05	*n.f.*	44″·87	Hj I	1 night.
1862·31	59·3	58·41	Kn	1 „
1885·14	60·0	60·84	β	3 nights.

No. 339. δ *Hydræ.* (Smyth.)

R.A. 8h 31m 18s
Decl. + 6° 7′

1879·255	311°·5	243″·88	...9·0	8 : 35	II.

There is no other observation previous to my own, except Smyth's, 312°·0 : 210″·0 (1832·29).

No. 340. H. 99.

R.A. 8h 31m 59s
Decl. − 6° 23′

A and B.

1879·060	211°·1	64″·80	6·5...8·0	8 : 30	II
1881·184	211·0	64·44	6·5...7·5	8 : 30	II.
1880·12	211·0	64·62	6·5...7·7		

B and C.

1879·060	209°·1	9″·14	...11·5	8 : 40	II.
1881·184	210·1	9·19	...13·0	8 : 40	IV.
1880·12	209·6	9·16	...12·0		

The bright stars A and B were noted by Herschel, of which there are no other measures. The faint component is new.

No. 341. β 207.

R.A. 8h 33m 44s
Decl. − 19° 19′

1880·236	101°·5	4″·05	6·8...9·5	8 : 40	II.
1881·184	102·9	4·31	7·5...9·5	8 : 45	III.

The following are all the measures:

1876·08	103°·6	4″·32	De	3 nights	6·5...10·5
1877·10	106·1	4·54	Cin	3 „	
1880·71	102·2	4·18	β	2 „	7·1...9·5

No. 342. 31 *Monocerotis.* S. 579.

R.A. 8h 37m 46s
Decl. − 6° 48′

1879·192	308°6	78″93	4·5...7·0	9 : 15	II.
1881·151	309·0	77·58	6·0...9·0	9 : 25	II.
1881·206	308·7	78·53	6·0...8·5	9 : 25	II.

There is a faint star nearer than this, in the direction of about 335°. These are the only measures:

1824·02	308°6	77″92	S	2 nights.
1880·52	308·8	78·35	β	3 „

No. 343. δ *Cancri.* H. 457.

R.A. 8h 37m 54s
Decl. + 18° 36′

1879·131	113°2	41″90	5·0...12·0	8 : 45	II.

The change is due to proper motion.

No. 344. ε *Hydræ.* Σ 1273.

R.A. 8h 40m 26s
Decl. + 6° 52′

A and B.

1879·060	223°6	3″53	...9·0	9 : 00	II.
1880·263	223·2	3·49	—	—	III.
1879·66	223·4	3·51			

A and C.

1879·225	191°7	19″55	...13·0	9 : 20	III.

The only measures of the third star, discovered by HOLDEN, are:

1878·33	193°9	19″78	Hl	1 night.
1878·60	192·0	20·05	β	2 nights.

No. 345. β 407.

R.A. 8h 45m 50s
Decl. − 6° 20′

1879·134	163°8	6″01	8·0...10·7	8 : 50	III.
1879·197	165·4	5·83	7·8...10·5	8 : 10	II.
1880·236	164·3	5·98	8·0...10·0	8 : 55	III.
1879·52	164·5	5·94	7·9...10·4		

No. 346. 15 *Hydræ.* β 587.

R.A. 8h 45m 41s
Decl. − 6° 44′

A and B.

1879·134	153°0	0″52	5·5...7·0	8 : 40	III.
1879·225	162·5	0·43	6·0...7·5	9 : 05	IV.

An excessively difficult pair. Hl noted two very distant companions (= Hl v. 120). The following are all the measures of the new pair:

1878·37	163°6	0″37	Cin	3 nights.
1878·69	158·8	0·46	β	4

No. 347. β 103. (7·9 and 10·8.)

R.A. 8h 49m 1s
Decl. − 7° 21′

1879·134	72°9	2″74	8·0...11·5	9 : 00	III.
1879·197	74·6	2·79	8·0...11·0	8 : 15	II.
1880·236	74·1	3·04	7·8...10·0	9 : 05	III.

The following are all the measures:

1875·08	73°9	2″90	De	2 nights.
1879·52	73·9	2·86	β	3 „

No. 348. α *Cancri.* H. 110.

R.A. 8h 51m 54s
Decl. + 12° 19′

1879·060	325°8	10″77	4·0...11·5	9 : 10	II.
1879·131	324·5	11·04	...12·5	8 : 50	II.
1879·200	324·6	11·40	5·0...12·5	9 : 15	II.

H. called the small star 20 mag. There is evidently an error in the first figure of

H.'s angle, printed 224°·3. The following are all the measures:

1836·00	326°·3	11″·19	Lamont.	
1867·78	325·5	11·42	De	3 nights.
1879·13	325·0	11·07	β	3 „

No. 349. β 409.

R.A. 8h 54m 55s
Decl. − 8° 43′

1879·134	184°·0	9″·89	7·5...11·0	9 : 10	III.
1879·197	184·6	9·77	8·0...10·5	8 : 25	II.
1880·236	185·4	9·64	8·0...10·2	9 : 15	II.
1872·52	184·7	9·77	7·8...10·6		

No other measures.

No. 350. Σ 1302.

R.A. 8h 54m 59s
Decl. + 3° 13′

A and B.

1879·233	233°·2	1″·90	—	—	II.
1881·151	232·9	2·01	8·5... 8·5	9 : 35	II.
1881·206	232·5	2·21	8·8... 9·0	9 : 35	III.

A and C.

1879·233	269°·5	31″·92	...12·0	—	II.

The third star has not been seen before. There is not much change in AB:

1829·59	228°·1	2″·38	Σ	3 nights.
1879·37	233·1	2·08	Cin	1 night.
1880·53	232·9	2·07	β	3 nights.

No. 351. θ *Hydræ*. Ḥ v. 54.

R.A. 9h 8m 8s
Decl. + 2° 49′

1879·255	175°·0	53″·15	...10·5	9 : 10	II.
1881·151	175·3	52·23	...10·5	9 : 40	II.
1880·20	175·2	52·69	...10·5		

Not measured by Ḥ, but H. gives the angle 169°·8. The only measures prior to the above are found in the Bedford Catalogue, 168°·6 : 45″·0 (1835·27).

No. 352. W. ix. 147.

R.A. 9h 9m 1s
Decl. − 8° 16′

1879·060	14°·8	25″·72	7·5...8·5	9 : 20	II.
1881·151	14·3	25·81	8·0...9·3	9 : 50	II.
1880·10	14·5	25·76	7·7...8·9		

Noted 'duplex' in Weisse. No other measures.

No. 353. Ο Σ 198 *rej.*

R.A. 9h 9m 16s
Decl. + 23° 55′

1879·206	167°·3	16″·12	8·0...12·5	9 : 15	V.

No other measures. De. was unable to see the small star.

No. 354. *Hydræ* 95. β 212.

R.A. 9h 10m 12s
Decl. − 7° 51′

1880·236	231°·9	1″·35	7·8...8·0	9 : 30	II.
1880·269	230·8	1·11	7·8...8·0	9 : 05	III.
1880·277	225·2	1·10	—	9 : 00	III.
1881·206	227·6	1·47	8·0...8·7	9 : 45	III.

The following are all the measures of this pair:

1875·61	230°·5	1″·48	De	2 nights.
1878·23	225·8	1·36	Cin	4 „
1880·50	228·9	1·26	β	4 „

No. 355. Σ 3121. (7·2 and 7·4.)

R.A. 9h 10m 46s
Decl. + 29° 7′

1879·206	193°·3	0″·37	7·5...7·5	9 : 25	V.
1879·225	192·8	0·42	7·0...7·1	9 : 45	V.
1880·315	199·8	0·50	7·0...7·5	10 : 00	V.

One of the most interesting binary systems. DOBERCK (1877) gives 37·03 years for the period. Some of the later measures are:

1866·22	199°·6	0″·68	De	4 nights.
1875·29	250·1	Obl.	0 Σ	1 night.
1878·21	185·2	0·36	β	1 „
1879·21	193·0	0·40	β	2 nights.
1880·31	199·8	0·50	β	1 night.

No. 356. *Cancri* 222. H. 128.

R.A. 9h 11m 21s
Decl. + 12° 0′

1879·172	277°·8	29″·43	6·5...13·0	9 : 30	II.

H. called the small star 20 mag., and gave the angle 283°·5. There are no other observations.

No. 357. 38 *Lyncis.* Σ 1334.

R.A. 9h 11m 23s
Decl. + 37° 19′

1880·373	236°·0	2″·68	—	11 : 20	IV.

Measured just after sunset.

No. 358. Σ 1343. (8·3 and 8·5.)

R.A. 9h 13m 41s
Decl. + 5° 31′

1880·167	273°·6	9″·76	8·0...8·2	10 : 00	II.
1881·151	272·4	9·66	—	10 : 00	II.
1881·184	272·4	10·22	8·7...8·8	9 : 00	II.

From some of the measures since STRUVE, it appeared there was a considerable change in the distance, but the measures given above negative any such conclusion.

1836·22	271°·1	10″·22	Σ	3 nights.
1843·21	271·0	9·60	Ma	2 „
1863·30	269·4	6·79	Ferguson	1 night.
1880·83	272·8	9·88	β	3 nights.

No. 359. κ *Leonis.* β 105.

R.A. 9h 17m 40s
Decl. + 26° 42′

1879·060	202°·4	2″·89	4·5...10·5	9 : 50	II.

The only other measures are:

1876·20	203°·8	3″·05	De	5 nights.
1878·33	203·8	2·89	Hl	2 „

No. 360. 41 *Lyncis.* S. 598.

R.A. 9h 20m 48s
Decl. + 46° 8′

1880·373	161°·8	81″·64	4·0...8·0	11 : 40	III.

The only prior measures are:

1824·72	161°·5	86″·65	S	3 nights.
1874·14	161·7	82·51	De	1 night.

No. 361. α *Hydræ.* H vi. 111.

R.A. 9h 21m 41s
Decl. − 8° 8′

1879·255	152°·8	281″·27	...9·0	8 : 50	II.

The only measures before this are by SMYTH.

No. 362. ω *Leonis.* Σ 1356.

R.A. 9h 22m 2s
Decl. + 9° 35′

1879·206	80°·0	0″·45	5·8...6·2	9 : 40	V.
1879·225	81·3	0·50	6·0...6·3	9 : 35	V.
1880·320	81·4	0·52	—	9 : 50	V.
1880·345	76·6	0·59	—	10 : 50	V.
1879·78	79·8	0·51			

No. 363. 3 *Leonis*. ♅ iv. 47.

R.A. 9h 22m 6s
Decl. + 8° 43′

1879·060	79°·5	25″·02	6·0...10·8	9 : 25	II.
1881·206	79·4	25·06	6·0...10·7	9 : 55	III.

Not measured by ♅, and by no one since except SMYTH. The mean of the above and one previous measure gives: 79°·2 : 25″·14 (1879·48) 3 *n*.

No. 364. β 213.

R.A. 9h 22m 25s
Decl. − 7° 34′

1879·134	177°·2	1″·66	7·8...10·0	9 : 25	III.
1881·206	181·5	1·40	8·0...10·0	10 : 05	III.
1880·17	179·3	1·53	7·9...10·0		

No. 365. Σ 1357.

R.A. 9h 22m 29s
Decl. − 9° 28′

1880·280	52°·9	7″·17	8·0...10·3	9 : 05	II.
1881·206	54·4	7·53	7·8... 9·5	10 : 15	II.
1880·74	53·6	7·35	7·9... 9·9		

Without change.

No. 366. Σ 1365.

R.A. 9h 25m 20s
Decl. + 2° 0′

1880·222	157°·7	3″·35	7·0.. 8·3	7 : 20	III.
1881·206	160·2	3·45	—	10 : 25	II.
1880·71	158·9	3·40			

Some of the measures are discordant, but probably there is not much change.

No. 367. 14 *Leonis*. ♅ vi. 76.

R.A. 9h 34m 45s
Decl. + 10° 26′

1879·258	41°·4	80″·28	5·0...9·5	8 : 40	II.
1882·195	41·2	81·17	6·0...9·5	9 : 15	III.
1882·208	41·7	81·38	—	9 : 30	II.
1882·233	41·2	80·74	...8·8	9 : 50	III.

The change is evidently due to proper motion. The following are all the measures:

1783·08	40°·4	63″·48	♅	1 night.
1823·27	36·4	70·83	Sh	1 „
1881·47	41·4	80·89	β	4 nights.

No. 368. *O* Σ 206 *rej*.

R.A. 9h 35m 41s
Decl. + 17° 38′

1879·200	232°·8	17″·43	8·0...11·8	9 : 40	II.

Distance increasing?

1849·28	234°·3	16″·43	Ma	2 nights.
1867·47	234·0	17·28	De	3 „

No. 369. ψ *Leonis*. (SMYTH.)

R.A. 9h 37m 12s
Decl. + 14° 34′

1880·162	139°·7	280″·38	6·0...10·0	9 : 40	II.
1880·167	139·5	280·66	... 9·5	10 : 15	II.
1880·184	139·7	279·73	... 9·5	9 : 25	II.
1880·17	139·6	280·26	... 9·7		

The only other measures are in the Bedford Catalogue.

No. 370. Σ 1377.

R.A. 9h 37m 14s
Decl. + 3° 11′

1880·222	140°·0	3″·68	7·8...9·0	7 : 40	III.
1882·195	140·6	3·83	8·0...9·7	9 : 45	II.
1881·21	140·3	3·75	7·9...9·3		

Some of the measures are discordant in angle, but taken together seem to show a larger distance.

1830·24	142°·2	3″·32	Σ	4 nights.
1879·33	140·0	3·75	Hl	2 „

No. 371. 8 *Sextantis*. A.C. 5.

R.A. 9h 46m 34s
Decl. − 7° 32′

1879·206. Perhaps a slight elongation in 180°, but very doubtful.

A and C.

1880·280	145°·3	35″·86	—	9 : 30	II.

No other measures of the distant companion.

No. 372. β 592.

R.A. 9h 49m 16s
Decl. − 15° 38′

1879·060	189°·7	9″·77	6·5...11·5	10 : 15	II.
1880·167	193·7	10·05	6·5...11·5	10 : 30	II.
1880·236	191·4	9·77	6·7...12·0	10 : 00	II.
1879·82	191·6	9·86	6·6...11·7		

No. 373. Σ 1401.

R.A. 9h 53m 56s
Decl. + 6° 50′

1880·222	21°·6	23″·63	8·0...10·0	7 : 55	II.
1882·195	22·0	23·86	8·0... 9·2	9 : 30	II.
1882·246	22·5	23·71	8·0... 9·5	8 : 35	II.
1881·55	22·0	23·73	8·0... 9·6		

Unchanged.

No. 373*a*.

R.A. 10h 0m 48s
Decl. − 1° 8′

1879·206	351°·7	2″·01	9·0 ..9.0	10 : 00	III.
1882·195	351·9	1·87	9·0...9·0	9 : 50	II.
1880·70	351·8	1·94	9·0...9·0		

Noted as double in Harvard zones, 'very close.' No other measures.

No. 374. β 218.

R.A. 10h 1m 41s
Decl. − 19° 7′

1880·274	117°·9	0″·96	8·0...8·2	10 : 30	III.

The other measures of this pair are:

1875·31	122°·6	0″·99	De	4 nights.
1878·53	121·9	0·97	Cin	3 „

No. 375. α *Leonis*.

R.A. 10h 2m 0s
Decl. + 12° 33′

A and B.

1879·175	306°·7	176″·14	Bright wires.	II.
1879·175	306·7	175·96	Bright field.	II.

B and C. (Winlock.)

1880·315	87°·7	3″·03	8·3...13·0	10 : 20	II.

The only other measures of the close pair are:

1877·75	86°·4	3″·48	Hl	5 nights.
1878·14	88·5	3·29	β	4 „

No. 376. Σ 1416.

R.A. 10h 6m 29s
Decl. − 15° 30′

1880·219	274°·9	11″·36	7·0...8·5	9 : 30	II.
1882·195	276·9	11·64	7·8...8·7	10 : 10	II.

There are large differences in the estimates of the magnitudes. H. gave them 9 and 10. The following are all the measures:

1827·73	275°·8	11″·25	Σ	2 nights	6·7...8·5
1878·22	276·0	11·64	Cin	2 „	8·0...9·5
1880·90	276·2	11·61	β	3 „	7·4...8·6

No. 377. B.A.C. 3506. *O* Σ 215.

R.A. 10h 9m 44s
Decl. + 18° 20′

1879·206	224°·3	0″·67	6·8...7·0	10 : 15	IV.

Binary in slow retrograde motion.

No. 378. 39 *Leonis*. *O* Σ 523. (6 and 12·5.)

R.A. 10h 10m 39s
Decl. + 23° 43′

1879·200	300°·7	7″·30	...13·0	10 : 20	II.
1879·225	299·5	7·18	6·0...13·0	10 : 35	III.
1880·315	298·4	6·91	6·0...11·8	10 : 35	II.
1880·370	297·0	6·67	...12·3	12 : 30	II.

These stars have a common proper motion, and probably belong to the same system. The following are some of the epochs:

1851·36	295°·6	6″·73	O Σ	4 nights.
1861·24	298·0	6·96	O Σ	2 „
1878·96	300·2	7·10	III	3 „
1879·78	298·9	7·02	β	4 „

No. 379. β 25 (=Schj. 12).

R.A. 10h 15m 46s
Decl. − 9° 10′

1879·134	180°·0	1″·63	8·0...8·5	10 : 05	II.
1882·195	179·9	2·03	8·3...8·5	10 : 15	II.
1882·246	182·8	1·67	8·0...8·7	9 : 00	II.
1881·19	180·9	1·78	8·1...8·6		

No. 380. *Leonis* 155. Sh. 115.

R.A. 10h 17m 2s
Decl. + 6° 18′

1880·219	341°·9	58″·57	6·7...9·0	9 : 50	II.
1880·269	341·8	58·66	—	—	II.
1880·329	341·5	58·55	7·2...8·5	11 : 50	II.

There is certainly some change in angle. There is a singular difference in the distances of the last two sets of measures:

1823·14	330°·4	60″·39	Sh	3 nights.
1879·34	341·2	59·47	Cin	3 „
1880·27	341·7	58·59	β	3 „

No. 381. H. 2529.

R.A. 10h 17m 19s
Decl. + 13° 10′

1879·225	8°·3	18″·96	10·0...(12)	—	III.
1882·195	7·5	18·96	10·0...(12)	10 : 25	III.
1880·72	7·9	18·96			

Described by H.:

'AB 95°·3 : 1″½ ± : 11·0...12·0
AC 10·8 : 7 ± : ...14·0

'A most curious, delicate, and interesting object. The nucleus of a very faint nebula.' H. also suspected another star, 14–15 mag., about 6″ distant, in the direction of 330°. This note would seem to indicate the closer pair was the nucleus

of the nebula, and not the 14 mag. companion. However this may be, the nebula now is 19″ from the principal star. As this angle agrees substantially with H., and his distance is only estimated, there is no reason for suspecting change. I could not see any signs of duplicity in the 10 mag. star, but the conditions were not particularly favourable. There is an excessively faint star about 8″ from A in the direction of 230°, noted in my first observation. On the second occasion the seeing was too poor to show it. This may be the star suspected by H., although the direction is different. I am not prepared to say that the principal star is not double, but if so, it must be closer than 1½″. It is rather strange that this nebula should have escaped modern observers, and have been omitted in the General Catalogue by H. himself, as well as the continuation of this catalogue by DREYER. I have estimated it as equivalent to a star of 12 mag., and it should, therefore, be apparent as a nebula with a comparatively small aperture.

No. 382. Σ 1432.

R.A. 10h 20m 14s
Decl. + 30° 17′

1880·219	123°·2	28″·69	—	10 : 00	II.

No other measures since Σ, and probably fixed.

No. 383. Σ 1442.

R.A. 10h 25m 24s
Decl. + 22° 39′

1880·367	154°·2	13″·18	8·0...8·0	13 : 00	II.

Fixed.

No. 384. H. 2534.

R.A. 10h 26m 14s
Decl. + 41° 12′

1879·241	316°·0	24″·80	5·5...12·0	8 : 30	II.
1879·258	315·6	24·48	6·0...12·5	8 : 55	II.
1879·25	315·8	24·64	5·7...12·2		

No prior measures except H.'s angle of 314°·6. This star is erroneously called 32 *Leo Minoris* by H. The declination given by H. is 10′ too large. I have identified it as B.A.C. 3607.

No. 385. Σ 1445.

R.A. 10h 26m 35s
Decl. − 0° 15′

1880·167	163°·7	2″·86	8·5...9·7	11 : 00	II.
1882·195	161·4	2·87	8·5...9·7	10 : 40	II.

The later measures do not agree very well with STRUVE, but still show no sensible change in the last twenty years :

1827·58	167°·4	2″·42	Σ	3	nights.
1864·87	159·4	2·95	De	3	„
1880·14	161·7	2·81	β	3	„

No. 386. H. 487.

R.A. 10h 29m 29s
Decl. + 30° 44′

1879·241	360°·4	12″·06	9·0...9·0	8 : 20	II.

No other measures.

No. 387. *O* Σ 223. (7·6 and 11·9)

R.A. 10h 31m 11s
Decl. + 41° 4′

1879·241	143°·7	19″·44	7·5...12·0	8 : 40	II.
1879·258	143·0	19·62	7·7...11·8	9 : 10	II.

Ma. gave the angle 160°·6 (1842·3). The only other measures are:

1868·21	146°·6	18″·60	De	3 nights.
1879·25	143·3	19·53	β	2 „

No. 388. *O Σ* 224.

R.A. 10h 33m 26s
Decl. + 9° 28′

1880·167	334°·3	0″·62	8·0...9·0	11 : 20	IV.

Binary.

No. 389. H. 2543.

R.A. 10h 37m 23s
Decl. + 33° 7′

1879·255	34°·8	2″·83	9·0...9·5	10 : 15	II.

Described by H.: '31°·0 : 1½″ : 10...11. A third 15m, 15″ *s. p.*' There are no other measures since. I noted a faint star about 20″ in the direction of 241°. The principal star is 9·1 mag. in D.M. (33°) 2021.

No. 390. β 595.

R.A. 10h 42m ±
Decl. − 14° 23′ ±

1879·200	17°·8	2″·00	8·5...10·0	10 : 00	II.

No. 391. 41 *Sextantis*. (Smyth.)

R.A. 10h 44m 17s
Decl. − 8° 16′

A and C.

1879·337	72°·5	233″·48	—	—	II.
1879·340	72·3	233·42	—	10 : 50	II.
1879·34	72·4	233·45			

This is supposed to be the star measured by Smyth, 120°·4 : 290″·0 (1838·31). It is undoubtedly the one, as there is no companion any nearer Smyth's place. A measure of H.'s companion will be found in my first series.

No. 392. Σ 1478.

R.A. 10h 44m 33s
Decl. + 25° 5′

1880·370	348°·2	8″·60	8·0...11·3	12 : 45	II.

Unchanged.

No. 393. β 111. (9·0 and 9·6.)

R.A. 10h 45m 10s
Decl. − 8° 28′

1879·134	6°·0	3″·56	9·0...9·5	10 : 40	II.
1882·195	6·6	3·62	9·0...9·1	10 : 50	II.

The following are all the measures:

1875·21	3°·3	3″·22	De	3 nights.
1880·66	6·3	3·59	β	2 „

No. 394. Σ 1494.

R.A. 10h 51m 45s
Decl. + 37° 40′

1879·241	332°·5	10″·12	8·5...10·5	8 : 55	II.

Very little movement.

No. 395. β *Ursæ Majoris*. (Smyth.)

R.A. 10h 54m 36s
Decl. + 57° 1′

1879·293	353°·9	245″·0	...9-10	Single distance.

Measured roughly in attempting to

identify the Bedford Catalogue companion, 172°·6 : 75″·0 (1831·37). There is no star in that place.

No. 396. Σ 1504.

R.A. 10h 57m 48s
Decl. + 4° 17′

1879·225	282°·4	0″·89	7·5...7·5	10 : 50	III.

No. 397. Σ 1517.

R.A. 11h 7m 24s
Decl. + 20° 47′

1879·225	281°·1	0″·83	7·5...7·5	—	III.

No. 398. δ *Leonis*. (Smyth.)

R.A. 11h 7m 42s
Decl. + 21° 11′

A and B.

1879·255	44°·5	95″·20	...10·5	11 : 25	II.
1879·285	44·2	95·55	–	11 : 30	II.
1879·26	44·3	95·38			

A and C.

1879·255	345°·2	—	...9·0	11 : 35	II.
1879·285	344·7	—	–	11 : 35	II.

The only other measures are those of Smyth.

No. 399.

R.A. 11h 9m ±
Decl. + 52° 15′ ∓

1880·373	210°·3	6″·79	8·2...9·5	14 : 00	II.

Discovered by Winnecke.

No. 400. *Crateris* 36. Sh. 120.

R.A. 11h 10m 54s
Decl. – 6° 29′

A and C.

1880·301	97°·7	60″·69	6·0...8·0	10 : 45	II.

The principal star has a very minute attendant at a distance of 1″·25 (=β 600). The following are all the measures of the wide pair:

1823·31	97°·6	67″·06	Sh	1 night.
1878·89	97·4	61·25	β	3 nights.

No. 401. ν *Ursæ Majoris*. Σ 1524.

R.A. 11h 12m 0s
Decl. + 33° 45′

1880·367	143°·8	6″·42	—	12 : 30	II.

(Very unsteady.)

No. 402. Σ 1530.

R.A. 11h 13m 40s
Decl. – 6° 15′

1880·222	313°·3	7″·89	7·8...8·0	9 : 35	II.

Fixed.

No. 403. β 601. (AB=S. 627.)

R.A. 11h 22m 54s
Decl. – 16° 40

B and C.

1879·342	232°·3	0″·73	8·0...9·0	11 : 20	II.

The only measures are:

1878·83	229°·6	0″·77	β	2 nights.
1879·73	224·6	0·87	Cin	4 „

No. 404. *O Σ* 234.

R.A. 11h 24m 20s
Decl. + 41° 57′

1880·373	178°·4	0″·18	—	13 : 40	V.

Excessively difficult. A rapid binary, of which there are but few measures.

No. 405. Σ 3072.

R.A. 11h 24m 44s
Decl. − 6° 3′

1880·222	330°·4	9″·53	8·0...9·0	9 : 45	II.

Unchanged.

No. 405*a*. Σ 1555.

R.A. 11h 29m 59s
Decl. + 28° 27′

A and B.

1882·233	345°·5	0″·56	7·5...7·5	10 : 25	V.
1882·236	350·2	0·96	—	9 : 45	V.
1882·246	343·9	0·83	—	9 : 30	III.
1882·24	346·5	0·68			

AB and C (= H. 503, 504).

1882·233	145°·4	20″·98	...11·0	10 : 20	III.
1882·236	145·0	21·25	—	9 : 50	III.
1882·246	144.9	21.27	...10·8	9 : 25	II.

Probably very slow direct motion in the close pair. The faint star, detected by H., is not in Σ. The only measures of this, excluding that of the Bedford Catalogue, are:

1865·3	142°·4	13′·42	En	1 night.
1871·31	145·4	21·11	De	
1882·24	145·1	21·17	*β*	3 nights.

There is evidently an error in the distance of ENGELMANN. SADLER has suggested there may have been an error of one revolution of the micrometer screw in recording the double distance. Thus corrected, the distance would be 20″·73, in fair accordance with the later measures.

No. 406. Σ 1560.

R.A. 11h 32m 15s
Decl. − 1° 46′

1880·222	281°·2	4″·84	6·2...10·0	10 : ∞	II.
1880 274	279·1	5·24	6·8...10·0	11 : 10	II.
1880·25	280·1	5·04			

Unchanged.

No. 407. H. 508.

R.A. 11h 35m 53s
Decl. + 40° 20′

1879·258	127°·7	11″·21	8·3...9·0	—	II.

The only prior measure is by H., 131°·7 : 8″·00 (1828·3).

No. 408. B.A.C. 3992. *β* 603.

R.A. 11h 42m 28s
Decl. + 14° 57′

1880·266	336°·7	1″·34	7·0...10·0	12 : ∞	II.
1880·299	334·7	0·91	6·0... 9·5	—	V.

The mean of all the measures is:

1879·25	336°·7	1″·32	*β*	4 nights	6·6...10·4

No. 409. *O Σ* 241.

R.A. 11h 50m 8s
Decl. + 36° 7′

1880·375	126°·1	1″·55	6·8...8·5	13 : ∞	II.

There may be an increase in the angle, as O Σ found 119°·1 (1849·32), and DE. 121°·5 (1867·99).

No. 410. Σ 1586.

R.A. 11h 50m 42s
Decl. + 41° 1′

1879·241	249°·9	1″·60	8·3...10·0	9 : 10	II.

Probably unchanged; only observed by MA. since Σ.

No. 411. Σ 1594.

R.A. 11h 57m 21s
Decl. + 42° 4′

A and B.

1879·263	160°·4	15″·22	8·5...9·0	8 : 50	II.

A and C.

1879·263	82°·5	—	...13-14	8 : 55	

B and C.

1879·263	41°·5	—	—	9 : ∞	II.

No other measures of the faint star. The later measures of B make the distance less than Σ, but show no sensible change in the last fifteen years:

1831·93	165°·0	16″·95	Σ	2 nights.
1867·39	162·8	15·43	De	3 ,,
1879·40	160·5	15·45	Hl	2 ,,

No. 412. β 458.

R.A. 11h 58m 8s
Decl. − 20° 22′

1879·342	232°·5	30″·35	8·0...10·5	11 : 35	II.

No. 413. H. 2596.

R.A. 12h 1m 15s
Decl. + 43° 46′

1879·241	239°·6	34″·16	8·0...10·5	9 : 25	II.

No other measures.

No. 414. *Virginis* 59. Σ 1604.

R.A. 12h 3m 15s
Decl. − 11° 11′

A and B.

1879·331	91°·1	11″·32	7·7...8·7	10 : 55	II.

A and C.

1879·331	93°·3	42″·92	...8·2	11 : 05	II.

Considerable change from proper motion.

No. 414*a*. Σ 1607.

R.A. 12h 5m 30s
Decl. + 36° 45′

A and B.

1880·375	358°·4	30″·52	8 2... 8·5	13 : 15	II.

B and C (= II. 202, 516).

1880·375	310°·1	20″·52	...12·5	13 : 20	II.

My two measures of the small star give 310°·0 : 20″·78 (1879·32). There are no other measures. The bright stars are slowly changing from proper motion.

1830·99	350°·3	33″·07	Σ	3 nights.
1879·32	358·2	30·68	β	2 nights.

No. 415. δ *Ursæ Majoris.* (SMYTH.)

R.A. 12h 9m 30s
Decl. + 57° 42′

1879·304	124°·1	188″·59	10 : 00		II.

SMYTH's are the only other observations.

No. 416. *O Σ* 245.

R.A. 12h 11m 28s
Decl. + 29° 36′

1880·370	276°·5	8″·30	6·7...10·5	14 : 35	II.

Without change.

No. 416*a*. *O Σ* 249.

R.A. 12h 18m 3s
Decl. + 54° 49′

A and B.

1879·285	310°·7	0″·52	7·0... 8·0	9 : 05	IV.

AB and C.

1879·285	150°·0	13″·25	...11·7	9 : 10	III.

No. 417. *O Σ* 250.

R.A. 12h 18m 31s
Decl. + 43° 45′

1879·263	335°·0	0″·53	7·6...7·6	9 : 20	IV.

Probably unchanged.

1845·98	330°·7	0″·44	*O Σ*	3 nights.
1878·70	332·0	0·50	*β*	2 „

No. 418. *O Σ* 251.

R.A. 12h 23m 8s
Decl. + 32° 3′

1879·370	Apparently single.	V.

No. 419. *β Canes Ven.* (SMYTH.)

R.A. 12h 28m 0s
Decl. + 42° 1′

1879·263	220°·5	276″·20	...9·0	—	II.

Only the measures of SMYTH prior to this time, 228°·0 : 297″·0 (1835·24).

No. 420. *β Corvi.* (SMYTH.)

R.A. 12h 28m 5s
Decl. − 22° 44′

A and B.

1879·255	129°·7	—	... 9·0	—	II.

A and C.

1879·255	292°·0	—	...10·0	—	II.

SMYTH gives only differences of R.A.

No. 421. *β* 607. (8·8 and 10·0.)

R.A. 12h 35m 2s
Decl. − 0° 48′

1879·285	316°·7	1″·02	9·0...9·5	11 : 50	II.
1880·222	315·4	1·22	8·8...9·5	10 : 55	II.

A pretty pair in the field with *γ Virginis*, 35s *p*. The mean of all the measures is :

1878·74	315°·9	1″·15	*β*	6 nights.

No. 422. *γ Virginis.* Σ 1670.

R.A. 12h 35m 37s
Decl. − 0° 47′

A and B.

1880·296	157°·1	5″·41	—	10 : 55	II.
1880·301	157·9	5·33	—	11 : 30	II.

B and C (= II. 214).

1880·222	88°·3	102″·71	...12·0	11 : 00	II.
1880·296	88·0	102·68	...11·3	10 : 50	II.
1880·301	87·6	102·94	...11·5	11 : 35	II.
1880·27	88·0	102·78	...11·6		

No other measures of the distant star noted by H.

No. 423. S. 642. (8·4 and 9·0.)

R.A. 12h 42m 49s
Decl. + 14° 42′

1879·378	30°·2	58″·12	8·3... 9·0	12 : 30	II.
1880·329	30·8	58·12	8·5... 9·0	12 : 20	II.

There seems to be a very decided change in this wide pair. The following are all the measures I have found:

1825·34	36°·2	54″·42	S	2 nights.
1879·85	30·5	58·12	β	2 „

No. 424. Σ 1717.

R.A. 12h 45m ±
Decl. + 89° 20′

1879·326	343°·3	8″·32	8·3... 9·3	12 : 20	II.

Very near the pole. The companion was not seen by De. in 1865, but I found it very plain with the 6-inch in 1876. The foregoing is the only measure since Struve, who found 340°·7 : 7″·80 (1832·89).

No. 425. δ *Virginis.* (Smyth.)

R.A. 12h 49m 34s
Decl. + 4° 3′

1879·255	142°·5	151″·71	...10·5	—	II.
1879·340	142·2	152·36	...10·5	11 : 25	II.
1879·30	142·3	152·03	...10·5		

No. 426. Σ 1609.

R.A. 12h 50m 4s
Decl. − 4° 13′

1880·301	149°·5	6″·05	7·6... 8·5	11 : 55	II.

Fixed.

No. 427. 44 *Virginis.* Σ 1704.

R.A. 12h 53m 29s
Decl. − 3° 10′

1880·296	53°·8	20″·42	—	11 : 45	II.

No. 428. 46 *Virginis.* A.G.C. 5.

R.A. 12h 54m 25s
Decl. − 2° 43′

1879·416	150°·0	1″·25	6·0...11·5	13 : 30	
1880·299	153·1	1·55	6·0... 9·0	11 : 30	III.

Discovered by Mr. Alvan G. Clark in 1876 with the 12-inch refractor now at Vienna. The mean of all my measures of this star is:

1879·10	151°·5	1″·44	β	4 nights.

No. 429. ε *Virginis.* (Smyth.)

R.A. 12h 56m 13s
Decl. + 11° 36′

1879·252	120°·6	240″·49			
1879·340	120·3	241·29	...11·8	11 : 50	II.
1879·30	120·4	240·89			

One of the Bedford Catalogue stars.

No. 430. Σ 1720.

R.A. 12h 58m 48s
Decl. + 83° 35′

1879·326	334°·7	1″·58	8·2...8·4	12 : 00	II.

The following are all the other measures of this pair:

1832·78	334°·5	1″·62	Σ	4 nights.
1879·32	334·9	1·47	Cin	1 night.

No. 431. *θ Virginis.* Σ 1724.

R.A. 13h 3m 44s
Decl. − 4° 54′

A and B.

1880·315	345°·1	7″·06	4·0...8·8	12 : 15	II.
1880·331	344·1	7·28	...9·0	12 : 20	II.
1880·32	344·6	7·17	...8·9		

A and C.

1880·315	296°·9	70″·94	...9·0	12 : 20	II.
1880·331	297·3	70·80	...9·0	12 : 25	II.
1880·32	297·1	70·87	...9·0		

Hj found the distance of C in 1782 to be 63″·88.

No. 431*a*. 42 *Comæ.* Σ 1728.

R.A. 13h 4m 10s
Decl. + 18° 10′

1879·367	194°·1	0″·68	—	—	V.
1879·370	190·2	0·68	—	12 : 45	IV.
1879·37	192·1	0·68			

No. 432. 53 *Virginis.* H. 2645.

R.A. 13h 5m 40s
Decl. − 15° 33′

1879·252	10°·0	71″·03	...12·13	—	II.

The two measures I have made of this distant companion give 9°·6 : 70″·91 (1878·74). The only other measures, found in the Bedford Catalogue, are, 35°·0 : 45″·0 (1833·40).

No. 433. (STONE.)

R.A. 13h 7m 57s
Decl. − 23° 39′

1879·375	335°·0	11″·46	7·0...11·3	13 : 20	II.

The only other measures are: CIN. 335°·3 : 12″·16 (1879·08) I *n*.

No. 434. 61 *Virginis.* Hj vi. 90.

R.A. 13h 12m 10s
Decl. − 17° 38′

1879·252	25°·8	191″·43	...10·5	—	II.
1879·285	25·8		—	—	II.

Hj found 345° ± : 73″·25 (1783·00). The change is due to proper motion.

No. 435. *α Virginis.* (SMYTH.)

R.A. 13h 18m 54s
Decl. − 10° 32′

A and B.

1879·252	32°·9	144″·42	...12·0		

A and C.

1879·340	61°·5	—″	...10·5	12 : 30	II.
1879·342	61·9	359·84	—	—	II.

The most distant star is probably the one measured by SMYTH.

No. 436. Σ 1743.

R.A. 13h 19m 5s
Decl. − 6° 57′

1880·331	76°·0	5″·32	8·5... 8·8	12 : 45	II.

Unchanged.

No. 437. *u Hydræ.* (SMYTH.)

R.A. 13h 23m 9s
Decl. − 22° 39′

1879·285	94°·1	138″·68	—	12 : 15	II.

The only other measures are in the Bedford Catalogue.

No. 438. 72 *Virginis.* Σ 1750.

R.A. 13h 24m 10s
Decl. − 5° 51′

1879·252	16°·7	29″·17			
1879·340	15·6	29·30	6·0...11·8	13 : ∞	II.

The few measures there are of this pair do not agree very well:

1831·58	16°·1	30″·06	Σ	4 nights.
1855·22	16·8	28·98	Σ	1 night.
1879·30	16·6	30·68	Cin	3 nights.
1879·30	16·1	29·24	β	2 „

No. 439. 75 *Virginis*. H. 2658.

R.A. 13h 26m 26s
Decl. − 14° 46′

1879·252	109°·7	78″·53...11·0	—	II.
1879·378	110·5	78·04...11·5	12:50	II.
1879·31	110·1	78·29 11·2		

H. gave the angle 110°·3. The only measure of distance is by SMYTH, 112°·0 : 93″·0 (1835·32).

No. 440. H. 2662.

R.A. 13h 29m 27s
Decl. + 33° 51′

1879·246	285°·8	25″·87	9·0...10·0	11:10	II.
1879·252	286·1	25·41	8·7... 9·0	11:∞	II.

The only earlier measure is the angle by H. 287°·5.

No. 441. Σ 1766.

R.A. 13h 31m 43s
Decl. + 30° 42′

1880·447	67°·9	19″·97	8·5...8·8	16:10	II.

Unchanged.

No. 442. 25 *Canes Ven.* Σ 1768.

R.A. 13h 32m 7s
Decl. + 36° 54′

1880·455	157°·8	0″·56	5...7·5	—	V.
1880·468	152·1	0·64	—	14:20	V.
1880·46	155·0	0·60			

No. 443. H. 3341.

R.A. 13h 32m 14s
Decl. + 28° 56′

1879·252	189°·6	1″·60	9·0...9·0	10:25	II.
1880·345	191·7	1·73	9·5...9·7	12:20	II.
1880·447	192·3	2·17	9·5...9·7	16:20	II.
1880·01	191·2	1·83	9·3. .95		

Probably unchanged.

No. 444. P. xiii. 163. (SMYTH.)

R.A. 13h 35m 7s
Decl. + 28° 40′

1879·246	228°·4	91″·61	6·7...11·0	11:30	II.
1879·252	227·9	91·56	—	10:35	II.
1879·25	228·2	91·58	6·7...11·0		

The only prior measures are by SMYTH, 215°·0 : 68″·0 (1831·26).

No. 445. Σ 1774 *rej.*

R.A. 13h 35m 39s
Decl. + 8° 13′

1879·263	134°·2	17″·93	6·7...10·0	10:40	II.

No other measures.

No. 446. Σ 1775.

R.A. 13h 37m 17s
Decl. − 3° 40′

1879·252	334°·7	27″·51	7·0...9·0	—	II.

Unchanged.

No. 447. β 223.

R.A. 13h 38m 58s
Decl. − 2° 43′

1880·331	344°·7	18″·75	80...10·0	13 : 10	II.

The only other measures are:

1875·65	343°·7	18″·73	De	3 nights.
1879·40	343·6	18·88	Cin	1 night.

No. 448. 85 *Virginis*. H. 2677.

R.A. 13h 39m 7s
Decl. − 15° 10′

1879·285	311°·9	43·39	—	12 : 30	II.
1879·370	311·7	43·14	6...11·7	13 : 35	III.
1879·33	311·8	43·26			

H. found the angle 317°·8 (1830). The only other measures are SMYTH'S, 320°·0 : 30″·0 (1834·28).

No. 449. τ *Bootis*. $O\Sigma$ 270.

R.A. 13h 41m 35s
Decl. + 18° 3′

1879·416	351°·9	8″·35	—	14 : 00	I.

No. 450. β 413.

R.A. 13h 42m 15s
Decl. − 27° 46′

1879·329	108°·8	78″·00	6·2...8·5	11 : 35.	II.

The principal star is blood-red.

No. 451. β 613.

R.A. 13h 46m 3s
Decl. + 35° 16′

A and B.

1880·370	149°·3	0″·92	9·0...9·0	15 : 00	III.

AB and C.

1880·370	83°·4	49″·21	...8·8	15 : 05	II.

Only a single measure of my own previous to this.

No. 452. 10 *Draconis*. H. 3342.

R.A. 13h 47m 56s
Decl. + 65° 19′

A and B.

1879·304	25°·7	56″·30	...13	10 : 35	II.

A and C.

1879·304	65°·0	86″·18	...11·8	10 : 40	II.

The only other observation is the angle by H. of AB, 23°·0.

No. 453. η *Bootis*. SH. 169.

R.A. 13h 48m 58s
Decl. + 19° 0′

1879·252	110°·8	114″·75	...9		
1879·342	111·0	114·50	—	13 : 20	II.

The only earlier measures, excepting SMYTH'S, are by SH.

1822·66	119°·5	126″·20	Sh.	2 nights.
1879·30	1:0·9	114·62	β	2 „

No. 454. β 461.

R.A. 13h 50m 36s
Decl. + 3° 34′

A and B.

1879·378	234°·9	33″·33	7·5...12·5	13 : 15	II.

A and C.

1879·378 216°·3 40″·55 ...11·8 13 : 20 II.

No other measures.

No. 455. Σ 1795.

R.A. 13h 54m 31s
Decl. + 53° 41′

1879·263 2°·8 7″·66 6·5...9·5 10 : 30 II.

No other measures since Σ. Unchanged.

No. 456. τ *Virginis*. Sh. 171.

R.A. 13h 55m 33s
Decl. + 2° 8′

1879·285 289°·6 79″·57 4...8·5 12 : 50 II.

Sh. gives 290°·0 : 79″·29 (1823·3). Nothing else since, except the observations of Smyth.

No. 457. Σ 1814.

R.A. 14h 6m 39s
Decl. + 50° 49′

1879·291 257°·3 11″·34 8·3...8·5 11 : 30 II.

Probably fixed.

No. 458. *O* Σ 279.

R.A. 14h 8m 0s
Decl. + 12° 34′

1879·436 249°·1 1″·95 7·0...11·5 13 : 45 II.

Without change.

No. 459. Σ 1820.

R.A. 14h 9m 5s
Decl. + 55° 53′

1879·263 66°·0 2″·46 7·8...8·0 11 : 15 II.

Slow direct motion. The angle has increased about 20° since 1831.

No. 460. H. 2714.

R.A. 14h 17m 18s
Decl. − 19° 15′

1879·331 276°·1 20″·03 7·5...11·8 13 : 55 II.

H.'s angle is 266°·4, but as he calls the small star difficult, this is not evidence of change. There are no other measures.

No. 461. Σ 1840.

R.A. 14h 17m 33s
Decl. + 68° 20′

1879·304 222°·9 27″·76 6·8...9·0 10 : 50 II.

No other measures since Σ, who found substantially the same angle and distance.

No. 462. Σ 1837.

R.A. 14h 18m 14s
Decl. − 11° 7′

1879·441 311°·7 1″·56 6·8...8·5 14 : 15 II.

Binary, in slow retrograde motion.

No. 463. H. 549.

R.A. 14h 18m 43s
Decl. + 30° 31′

1879·246	136°·3	30″·50	8·0...11·0	11 : 45	II.
1880·447	137·2	31·06	8·5...10·5	15 : 50	II.
1879·85	136·7	30·78	8·2...10·7		

The only other measure is H.'s angle, 143°·1.

No. 464. Σ 1843.

R.A. 14h 20m 15s
Decl. + 48° 23′

1879·301	186°·9	19″·86	7·5...8·2	12 : 40	II.

The following are all the measures except a single observation by Ma.:

1830·60	188°·1	20″·15	Σ	2 nights.
1878·78	187·3	19·94	β	2 „

No. 465. Σ 1848.

R.A. 14h 22m 29s
Decl. + 33° 29′

1880·370	360°·3	3″·17	8·2...11·5	16 : 20	II.

No other measures since Σ. Probably unchanged, as Σ gives 3°·4 : 3″·03(1832·12).

No. 466. Σ 1850.

R.A. 14h 23m 16s
Decl. + 28° 50′

1880·389	262°·1	25″·39	7·0...7·2	12 : 15	II.

Fixed.

No. 467. B.A.C. 4799. Σ 1852 *rej.*

R.A. 14h 23m 45s
Decl. − 3° 43′

1879·285	268°·4	25″·54	7·0...10	13 : 05	II.
1879·318	267·9	24·79	6·7...10	11 : 40	
1879·30	268·1	25·16	6·9...10		

Σ has no measures. Smyth found, 266°·5 : 40″·0 (1836·49). There are no other measures.

No. 468. β 462.

R.A. 14h 23m 46s
Decl. − 3° 11′

A and B.

1880·318	328°·9	1″·96	9·0...9·3	13 : 40	II.

A and C.

1880·318	65°·4	14″·81	...12·0	13 : 45	II.

At the time of finding the close pair, I did not notice the third star. The only other measures of AB are:

1877·42	324°·4	2″·01	De	2 nights.

No. 469. β 117.

R.A. 14h 24m 41s
Decl. − 15° 5′

1880·331	91°·4	2″·18	7·8...8·5	13 : 55	II.

This star (L. 26481) has a considerable proper motion, according to Argelander 0″·438 in the direction of 147°·4. A set of measures now would at once determine the question of physical relation between the components.* The other measures are:

1876·64	95°·8	2″·44	De	3 nights.
1877·11	93·8	2·05	Cin	1 night.
1880·38	92·0	2·41	Cin	1 „

No. 470. ρ *Bootis*. H. 2728.

R.A. 14h 26m 42s
Decl. + 30° 54′

* Measured June 19, 1883, 92°·9 : 2″·17, certainly common proper motion.

1879·296	333°·7	53″·67	...12·0	11 : 50	II.
1880·444	334·2	52·82	...11·5	16 : 40	II.
1879·87	334·0	53·25	...11·7		

H. gives the angle 333°·5; no other measures since.

No. 471. *α Coronæ.* (SMYTH.)

R.A. 15h 29m 36s
Decl. + 27° 7′

1879·296	216°·8	—	...·9	11 : 35	II.

No. 472. 5 *Ursæ Minoris.* H. 2733.

R.A. 14h 27m 48s
Decl. + 76° 14′

1879·301	129°·4	56″·45	...10·5	11 : 10	II.

H. gives the angle 131°·1. The only other measures are by SMYTH, whose distance, 45″·0, is probably too small.

No. 473. Σ 1861.

R.A. 14h 30m 56s
Decl. + 12° 42′

1879·318	173°·4	13″·70	8·2...8·5	12 : 20	II.

There is a minute star about 30″ distant, in the direction of 301°·3. Nothing else since Σ, except a measure by MA. Probably unchanged.

No. 474. β 226.

R.A. 14h 32m 5s
Decl. − 21° 49′

1879·441	82°·7	0″·95	7·8...8·0	14 : 30	II.

No. 475. ε *Bootis.* Σ 1877.

R.A. 14h 39m 45s
Decl. + 27° 35′

1879·473	325°·8	2″·88	—	16 : 55	

No. 476. β 31.

R.A. 14h 46m 59s
Decl. + 19° 13′

A and B.

1879·433	188°·4	1″·40	8·5...9·8	14 : 40	III.

The following are all the measures of the close pair:

1875·0	181°·6	1″·12	De	2 nights.
1878·84	188·1	1·35	β	2 „

No. 477. P. xiv. 212. SH. 190.

R.A. 14h 50m 27s
Decl. − 20° 52′

1880·318	288°·7	15″·08	6·0...8·0	14 : 00	II.
1880·512	290·6	15·23	—	—	II.
1880·41	289·6	15·15			

Remarkable for large proper motion, 2″·015 in the direction of 151°·2. Measures of some faint stars in the field will be found in my first series of observations.

No. 478. *O Σ* 289. (6·2 and 10·4.)

R.A. 14h 51m 1s
Decl. + 32° 47′

1880·370	115°·3	4″·10	6·2... 9·8	15 : 00	II.
1880·375	113·4	4·62	6·5...11·0	15 : 05	II.
1880·414	111·0	4·11	6·0...10·5	12 : 50	II.

Some change is probable.

1846·34	120°·3	4″·56	O Σ	3 nights.
1867·54	115·6	4·44	De	3 „
1880·39	113·2	4·28	β	3 „

No. 479. Σ 1893.

R.A. $14^h\ 51^m\ 10^s$
Decl. $+\ 29°\ 58'$

1879·296	247°·8	19″·98	8·0...8·6	11 : 10	II.

Some change in both angle and distance.

1832·40	261°·0	21″·60	Σ	5 nights.
1864·76	252·3	20·14	De	3 „

No. 480. 59 *Hydræ*. β 239.

R.A. $14^h\ 51^m\ 33^s$
Decl. $-\ 27°\ 10'$

1879·373	308°·5	0″·84	6·0...6·2	14 : 55	III.
1880·468	315·1	0·82	6·0...6·2	14 : 30	V.
1879·92	311·8	0·83	6·0...6·2		

The following are the principal measures:

1874·50	303°·7	0″·8	β	5 nights.
1880·38	307·4	0·90	Cin	4 „
1881·40	312·0	1·07	β	4 „

No. 481. Σ 1915.

R.A. $14^h\ 53^m\ 24^s$
Decl. $+\ 86°\ 27'$

1879·326	322°·9	2″·40	7·7...9·5	15 : 55	II.

The only other measures are:

1832·30	326°·0	2″·49	Σ	3 nights.
1879·31	319·0	2·51	Cin	2 „

No. 482. β *Ursæ Minoris*. (SMYTH.)

R.A. $14^h\ 51^m\ 6^s$
Decl. $+\ 74°\ 39'$

1879·301	342°·8	207″·82	...11·0	11 : 25	II.

The only other measures are by SMYTH, 5°·5 : 165″·0 (1833·64).

No. 483. 2 *Serpentis*. β 348.

R.A. $14^h\ 55^m\ 40^s$
Decl. $+\ 0°\ 20'$

1879·373	113°·6	0″·50	6·0...7·5	15 : 10	IV.
1880·468	115·4	0·45	6·0...7·0	14 : 50	V.
1879·92	114·5	0·47			

For comparison we have:

1875·75	114°·5	0″·45	De	4 nights.
1876·50	119·0	0·5	Shp	4 „
1881·41	119·7	0·45	β	4 „

No. 484. Σ 1901.

R.A. $14^h\ 55^m\ 59^s$
Decl. $+\ 31°\ 51'$

1879·296	199°·0	27″·13	7·8...9·5	11 : 15	II.

Distance steadily diminishing.

1831·49	203°·7	30″·34	Σ	2 nights.
1865·00	200·9	28·07	De	5 „

No. 485. S. 666.

R.A. $14^h\ 57^m\ 40^s$
Decl. $+\ 75°\ 23'$

1879·304	36°·4	171″·79	6·5...8·0	11 : 05	II.

No other measures since SOUTH:

1824·94	37°·9	173″·18	S	2 nights.

No. 486. ι *Libræ*. β 618.

R.A. $15^h\ 5^m\ 23^s$
Decl. $-\ 19°\ 20'$

A and B (Sh. 376).

1879·468	111°·2	57″·10	—	14 : 35	II.
1880·465	110·5	57·52	—	15 : 40	II.

B and C.

1879·468	23°·9	1″·70	10·0...11·0	14 : 40	II.
1880·465	23·0	1·79	10·0...10·5	15 : 45	II.

In the mean results I have combined my previous measures with those given above. There would seem to be some error in the distance of Sh. The following are all the measures of AB:

1781·39	112°·5	59″·07	Hl	1 night.
1822·84	111·6	50·63	Sh	1 „
1878·98	110·6	57·40	β	5 night.

The only measures of the close pair are my own:

1879·00	24°·8	1″·82	β	5 nights.

No. 487. Σ 1920.

R.A. 15h 6m 48s
Decl. + 47° 18′

1879·266	290°·3	18″·73	8·5...8·5	11 : 50	II.
1879·291	291·6	19·09	8·5...8·5	11 : 45	II.
1879·28	290·9	18·91	8·5...8·5		

No material change since Struve.

No. 488. Oσ 294.

R.A. 15h 9m 46s
Decl. + 56° 30′

1879·291	249°·9	2″·81	7·0...12·0	12 : 20	II.

Change in distance is probable.

1848·59	251°·3	3″·26	Oσ	3 nights.
1878·53	249·1	2·77	β	3 „

No. 489. δ *Bootis*. Σ 27 App. I.

R.A. 15h 10m 40s
Decl. + 33° 46′

1879·252	78°·7	104″·54	—	11 : 20	II.
1879·342	78·7	104·93	...8·3	13 : 50	II.
1879·473	78·4	104·93	—	—	
1879·479	78·6	104·67	—	17 : 00	II.

The stars are relatively fixed:

1835·66	78°·9	104″·87	Σ	5 nights.
1878·77	78·6	104·99	Jed	7 „
1879·39	78·6	104·79	β	4 „

No. 490. Σ 1926.

R.A. 15h 10m 23s
Decl. + 38° 45′

1879·296	258°·0	1″·25	7·0...9·0	12 : 15	III.

The measures are conflicting:

1830·60	260°·6	1″·59	Σ	4 nights.
1872·07	264·9	1·23	Du	4 „
1878·72	257·3	1·38	β	3 „

No. 491. 5 *Serpentis*. Σ 1930.

R.A. 15h 13m 10s
Decl. + 2° 14′

1879·378	39°·4	9″·82	5·7...10·5	15 : 00	II.
1879·463	39·3	10·31	cloudy	15 : 05	II.
1879·42	39·3	10·06			

No. 492. *Coronæ* 1. Σ 1932.

R.A. 15h 13m 12s
Decl. + 27° 16′

1880·395	305°·4	1″·22	7·8...7·8	13 : 25	III.

A binary, of which there are many measures.

No. 493. 6 *Serpentis*. β 32.

R.A. 15h 14m 54s
Decl. + 1° 9′

1879·378	12°·3	2″·38	6·0...11·0	14 : 50	II.
1879·433	14·9	2·37	5·5...10·8	16 : 00	II.

The following are all the other measures:

1875·41	13°·2	2″·28	De	4 nights.
1875·40	14·8	3·11	Hl	1 night.

No. 494. *η Coronæ.* Σ 1937.

R.A. 15h 18m 15s
Decl. + 30° 43′

1880·610	114°·9	0″·39	—	16 : 25	V.
1880·613	114·3	0·49	—	17 : 00	V.
1880·616	115·4	0·60	—	17 : 15	V.
1880·625	114·3	0·39	—	16 : 50	V.
1880·627	112·7	0·43	—	16 : 15	V.
1880·62	114·3	0·46			

No. 495. *μ Bootis.* Σ 1938.

R.A. 15h 20m 0s
Decl. + 37° 46′

B and C.

1879·296	131°·9	0″·84	—	11 : 50	III.
1880·370	131·3	0·83	—	16 : 40	V.
1880·375	129·7	0·83	—	15 : 45	V.
1880·392	124·0	0·76	—	15 : 00	V.
1880·460	126·4	0·64	—	14 : 15	V.
1880·18	128·7	0·78			

No. 496. Σ 1941.

R.A. 15h 20m 37s
Decl. + 27° 3′

1880·395	227°·4	1″·31	8·5...8·7	13 : 45	II.

Possibly a small change in the angle :

1832·0	232°·7	1″·61	Σ	4 nights.
1879·30	226·2	1·45	Cin	1 night.

No. 497. *ι Draconis.* (SMYTH.)

R.A. 15h 22m 16s
Decl. + 59° 23′

1879·263	50°·0	254″·67	...8·7	11 : 35	II.

The only other measure is in the Bedford Catalogue, the distance of which is about one-half that given above.

No. 498. Σ 1948.

R.A. 15h 23m 26s
Decl. + 55° 17′

1879·301	50°·3	12″·81	8·0...8·3	13 : 00	II.

Probably fixed. The only other measures are :

1830·34	50°·5	12″·24	Σ	3 nights.
1879·31	48·3	12·79	Cin	1 night.

No. 499. H. 2784.

R.A. 15h 24m 40s
Decl. + 50° 4′

A and B.

1879·266	228°·6	17″·36	9·5...10·5	12 : 00	II.

A and C.

1879·266	10°·8	41″·36	...11·0	12 : 05	II.

The only prior measure is the angle of AB by H., 226°·0. The distances are considerably under-estimated, 12″ and 20″.

No. 500. Σ 1958.

R.A. 15h 28m 20s
Decl. + 67° 37′

1879·304	338°·7	29″·76	8·5...8·7	11 : 25	II.

Unchanged.

No. 501. Σ 1964.

R.A. 15h 33m 41s
Decl. + 36° 38′

A and B.

1880·392	86°·6	15″·02	8·0...8·2	14 : 45	III.

B and C.

1880·392	9°·2	1″·14	...8·5	14 : 50	III.

These stars seem to have remained relatively fixed:

1830·87	86°·1	15″·36	Σ	3 nights	AB
1879·38	87·3	15·26	β	2 „	
1830·87	8·1	1·34	Σ	3 „	BC
1879·38	9·6	1·24	β	2 „	

No. 502. γ *Coronæ.* Σ 1967.

R.A. 15h 37m 42s
Decl. + 26° 41′

1879·468	No certain elongation.	Splendid night.
1880·482	Single with V.	Good night.
1880·559	„	

I found it single with the MADISON 15½-inch on two nights, 1881·47.

No. 503. α *Serpentis.* H. 1277.

R.A. 15h 38m 21s
Decl. + 6° 48′

1879·304	353°·2	58″·68	...12·0	12 : 20	II.

I have measured this once before, the two giving, 353°·8 : 58″·78 (1878·82). The only prior measure of distance, except the observation of SMYTH, is found in the Munich Observations, 61″·48 (1830).

No. 504. β 240.

R.A. 15h 39m 32s
Decl. + 4° 24′

A and B.

1880·465	135°·9	2″·49	8·5...9·0	15 : 20	II.

A and C.

1880·465	42°·1	31″·60	...11·5	15 : 25	II.

The only other measures are:

1875·90	135°·4	2″·35	De	4 nights.

No. 505. λ *Coronæ.* H vi. 94.

R.A. 15h 51m 25s
Decl. + 38° 18′

1879·293	64°·3	98″·34	5·0...9·5	12 : 30	II.

This star has not been measured before since H:

1783·65	56°·8	95″·23	H	1 night.

No. 506. ζ *Ursæ Minoris.* (SMYTH.)

R.A. 15h 48m 24s
Decl. + 78° 10′

1879·301	212°·9	313″·48	...11·8	11 : 45	II.

The other measures are by SMYTH.

No. 507. ε *Coronæ.* A.G.C. 7.

R.A. 15h 52m 37s
Decl. + 27° 14′

1879·373	352°·3	1″·94	...12·0	16 : 10	II.
1880·482	358·3	2·00	...12·5	14 : 40	V.

In the mean results given below, these measures are combined with two made in 1878. The following are all the observations up to this date:

1877·62	352°·7	2″·17	III	6 nights.
1879·14	357·8	1·91	β	4 „
1881·47	360·1	2·24	β	2 „

No. 508. ξ *Scorpii.* Σ 1998.

R.A. 15h 57m 46s
Decl. − 11° 3′

1879·499	188°·5	1″·17	unsteady	15 : 40	III.

No. 509. Σ 2006.

R.A. 15h 58m 1s
Decl. + 59° 16′

A and B.

1879·263	193°·1	1″·78	8·3...9·0	12 : 30 III.

A and C.

1879·263	219°·6	44″·58	...8·8	12 : 35 III.

There is considerable change in these stars:

1830·95	204°·5	1″·61	Σ	3 nights	AB
1869·32	197·4	1·65	De	5 „	
1878·84	195·0	1·72	β	2 „	
1830·62	223·7	43·54	Σ	2 „	AC
1868·47	221·1	44·31	De	4 „	

No. 510. 11 *Scorpii.* β 39.

R.A. 16ʰ 0ᵐ 57ˢ
Decl. − 12° 25′

1879·373	258°·6	3″·47	6·0...11·0	15 : 45 III.
1879·499	258·2	3·18	6·0...11·0	16 : 00 III.

For comparison we have:

1875·71	256°·5	3″·35	De	4 nights.
1879·49	258·4	3·33	β	2 „

No. 511. ν *Scorpii.* β 120.

R.A. 16ʰ 5ᵐ 1ˢ
Decl. − 19° 9′

A and B.

1879·373	362°·5	0″·65	4·0...5·0	15 : 40	IV.
1879·441	8·7	0·66	5·0...6·0	16 : 00	IV.
1879·468	4·0	0·65	5·0...6·0	15 : 15	IV.
1879·581	6·7	0·45	—	—	
1880·460	7·1	0·85	—	16 : 10	IV.
1880·468	6·6	0·67	—	15 : 30	V.
1880·559	4·0	0·62	—	16 : 35	V.
1880·627	10·0	0·71	—	17 : 05	V.

C and D.

1879·581	48°·2	(1″·15)	7·8...8·5	—	
1880·460	47·6	1·97	7·0...8·0	16 : 15	IV.

The close pair is certainly moving, and the four components probably form one system, but the change in CD is apparently very slow. Some of the measures are:

1875·94	359°·9	0″·73	De	11 nights	AB
1879·03	0·2	0·74	Cin	5 „	
1878·35	3·7	1·04	β	3 „	
1880·00	6·2	0·66	β	8 „	
1881·45	6·7	0·81	β	6 „	
1846·58	39°·0	1″·11	Mh	2 nights.	CD
1875·42	47·9	1·89	De	4 „	
1879·41	45·2	2·07	Cin	9 „	
1881·31	46·6	2·02	β	4 „	
1847·7	336°·5	40″·57	J	? nights.	AC
1875·43	336·5	40·77	De	4 „	
1881·60	336·6	40·97	β	3 „	

No. 512. δ *Ophiuchi.*

R.A. 16ʰ 8ᵐ 6ˢ
Decl. − 3° 23′

A and B.

1879·378	291°·6	64″·64	...12·5	15 : 20 II.

A and C. (SMYTH.)

1879·378	127°·2	265″·70	...10·0	15 : 25 II.

SMYTH gives, 131°·5 : 319″·0 (1834·45).

No. 513. Σ 2030.

R.A. 16ʰ 8ᵐ 38ˢ
Decl. + 41° 5′

1879·479	238°·1	5″·92	7·5...10·5	—	II.

Without change.

No. 514. σ *Coronæ.* Σ 2032.

R.A. 16ʰ 10ᵐ 12ˢ
Decl. + 34° 10′

A and B.

1880·395	203°·0	3″·61	—	14 : 20	V.

A and C.

1880·395	221°·4	15″·06	...13·5	14 : 25	V.

A and D.

1880·395	87°·6	55″·82	... 9·5	14 : 30	III.

No. 515. *υ Coronæ.* Sh. 223.

R.A. 16ʰ 11ᵐ 56ˢ
Decl. + 29° 27′

A and B.

1879·293	29°·9	56″·60	...12·0	11 : 50	II.
1879·345	29·2	55·37	...12·0	14 : 10	III.
1879·32	29·5	55·98	...12·0		

A and C.

1879·293	22°·3	86″·13	... 9·3	11 : 40	II.
1879·345	22·5	86·48	... 9·5	14 : 00	III.
1879·32	22·4	86·31	... 9·3		

A and D.

1879·293	52°·2	123″·85	... 9·0	11 : 45	II.
1879·345	52·3	123·37	... 9·0	14 : 20	III.
1879·32	52·2	123·61	... 9·0		

C and E.

1879·293	222°·0	13″·05	...10·5	11 : 35	II.
1879·345	223·4	13·41	...10·5	13 : 55	III.
1879·32	222·7	13·23	...10·5		

The nearest star has never been observed before. Sh. gives for AC, 24°·5 : 88″·69 (1823·4), and for AD, 54°·9 : 126″·42 (1823·4).

No. 516. *ν¹ Coronæ.*

R.A. 16ʰ 17ᵐ 50ˢ
Decl. + 34° 5′

1879·296	236°·6	66″·39	...10·5	12 : 35	II.

A nearer star than that measured by Σ, which is *ν²*. This is undoubtedly ℍ N. 81. ℍ gives no distance, but describes it as Class VI. and angle 220°±.

No. 517. *ν² Coronæ.* (Smyth.)

R.A. 16ʰ 17ᵐ 58ˢ
Decl. + 33° 59′

1879·293	15°·7	104″·68	—	11 : 15	II.
1879·296	15·5	104·45	...10·0	12 : 25	II.
1879·29	15·6	104·56			

In the Bedford Catalogue, 17°·9 : 137″·0 (1838·57). No other measures.

No. 518. *ω Herculis.* β 625.

R.A. 16ʰ 19ᵐ 52ˢ
Decl. + 14° 19′

A and B.

1880·468	181°·0	1″·85	5·5...10·8	16 : 35	

A and C.

1879·463	104°·3	34″·19	—	—	II.
1879·465	103·6	33·79	...11·0	16 : 35	II.

The mean results of my measures are:

1879·21	176°·8	1″·91	β	3 nights.	AB
1879·05	103·5	33·89	β	4 „	AC

No. 519. *Antares.*

R.A. 16ʰ 22ᵐ 3ˢ
Decl. − 26° 10′

1879·581	272°·8	2″·85	—	—	
1880·465	270·7	2·99	—	16 : 30	II.
1880·02	271·7	2·92			

No. 520. *η Draconis.* Oℤ 312.

R.A. 16ʰ 22ᵐ 22ˢ
Decl. + 61° 47′

A and B.

1879·274	141°·5	5″·48	...10·5	—	II.

Smyth's Star.

1879·274	18°·4	366″	single distance.
1879·359	18·8	367·	„ „

There are several small stars nearer than the one measured by Smyth; one about 107″ distant in the direction of 83°·5, another in 158°·3, and another in 172°·1. Smyth gave, 31°·0 : 190″·0 (1833·62).

No. 521. λ *Ophiuchi.* Σ 2055.

R.A. 16h 24m 52s
Decl. + 2° 15′

1880·460	39°·4	1″·39	—	16 : 30	IV.
1880·465	37·7	1·56	—	16 : 45	II.
1880·468	36·2	1·40	—	15 : 45	V.
1880·471	37·6	1·47	—	16 : 15	V.
1880·46	37·7	1·45			

No. 522. β *Herculis.* (Smyth.)

R.A. 16h 25m 4s
Decl. + 21° 45′

1879·304	274°·3	256″·15	...9·0	13 : 05	II.
1879·342	274·3	257·74	...9·0	14 : 10	II.
1879·32	274·3	256·94	...9·0		

The only other measures are in the Bedford Catalogue, 276°·0 : 278″·0 (1835·66).

No. 523. Σ 2080.

R.A. 16h 34m 26s
Decl. + 38° 34′

1879·296	25°·5	3″·53	8·0...12·0	13 : 35	II.

The change in this pair is very marked. The following are all the prior measures with the exception of a single angle by Ma.:

1830·39	29°·3	5″·61	Σ	3 nights.
1868·40	28·2	4·42	De	4 „

No. 524. ζ *Herculis.* Σ 2084.

R.A. 16h 36m 47s
Decl. + 31° 49′

1879·296	121°·2	1″·52	—	13 : 10	III.
1879·460	119·7	1·68	...8·5	18 : 10	III.
1879·592	125·2	1·36	—	—	
1880·392	111·4	1·48	—	—	V.
1880·406	115·2	1·53	—	15 : 15	III.
1880·482	115·7	1·35	—	15 : 10	V.
1880·589	115·0	1·17	—	16 : 15	V.
1880·610	113·3	1·31	—	17 : 00	V.

The mean results of the two sets are:

1879·45	122°·0	1″·52	β	3 nights.
1880·49	114·1	1·34	β	5 „

No. 525. Σ 2092.

R.A. 16h 37m 24s
Decl. + 60° 56′

1879·291	4°·0	8″·06	8·3...8·5	13 : 00	II.

The only measures of this pair are:

1831·10	5°·9	8″·04	Σ	3 nights.
1878·85	4·6	8·12	β	2 „

No. 526. η *Herculis.*

R.A. 16h 38m 47s
Decl. + 39° 9′

1879·266	261°·1	113″·39	—	13 : 10	II.
1879·468	Large star absolutely round				V.

The only early measure of the distant star is found in the Bedford Catalogue; 265°·0 : 141″·0 (1835·65).

No. 527. Σ 2099.

R.A. 16h 39m 15s
Decl. + 70° 35′

1879·274	218°·3	9″·64	8·7...11·0	13 : 25	II.

There is an error of −12′ Decl. in *Mens. Micr.* The principal star is D.M. (70°) 893. De. found the companion not measurable in 1865. The only measures since Σ are my own. The foregoing measure is not included in a subsequent set made at Madison:

1832·27	218°·9	9″·45	Σ	2 nights.	8·5...11·0
1881·48	218·9	9·63	β	3 „	8·7...10·8

No. 528. Σ 2097.

R.A. 16h 40m 28s
Decl. + 35° 57′

A and B.

1879·296	86°·0	2″·02	8·3...8·4	13 : 15	II.

A and C.

1879·296	5°·5	36″·84	...12·0	13 : 20	II.

The distant companion, first noticed with the 6-inch, has never been measured before. Later measures of the close pair make the angle less than found by Σ, the distance remaining substantially the same.

No. 529. Σ 2103.

R.A. 16h 44m 2s
Decl. + 13° 28′

1879·463	38°·5	5″·19	—	—	II.

Probably unchanged.

No. 530. Σ 2105.

R.A. 16h 45m 17s
Decl. + 1° 21′

1879·499	129°·1	29″·19	8·5...9·0	16 : 40	II.

No material change. In the field with 21 *Ophiuchi*.

No. 531. 21 *Ophiuchi*. OΣ 315.

R.A. 16h 45m 19s
Decl. + 1° 25′

1879·499	165°·0	1″·05	6·0...7·5	16 : 45	III.

Binary; slow retrograde motion.

No. 532. *Ophiuchi* 74. β 241.

R.A. 16h 48m 24s
Decl. − 21° 22′

1880·471	341°·0	0″·7 ±	—	16 : 00	

At the time of the discovery of this pair in 1874 with the 6-inch, the angle was roughly measured without driving-clock on four nights, the somewhat discordant results giving 134°·2. The later measures by themselves seem to indicate direct motion in angle, but the pair is not an easy one to measure in this latitude.

1879·06	159°·6	0″·63	Cin	5 nights.
1881·55	343·0	0·65	β	3 „

No. 533. B.A.C. 5700. Sh. 240.

R.A. 16h 50m 1s
Decl. − 19° 21′

1880·520	231°·7	4″·55	6·3...8·0	15 : 50	II.

The later measures make the angle a little more than Sh., and distance less.

No. 534. 56 *Herculis*. Σ 2110 *rej.*

R.A. 16h 50m 6s
Decl. + 25° 56′

1879·342	92°·7	17″·96	6·0...10·8	14 : 45	II.
1879·345	93·5	18·08	6·0...11·0	14 : 35	II.
1879·34	93·1	18·02	6·0...11·9		

The only other measures, except SMYTH's, are:

1879·38	93°·9	17″·88	Cin	2 nights.

No. 535. Σ 3107.

R.A. 16h 52m 52s
Decl. + 4° 9′

1879·433	100°·7	1″·28	8·5...8·5	17 : 00	II.

Slow retrograde motion.

1831·87	112°·3	1″·60	Σ	3 nights.
1864·53	104·4	1·32	De	3 „
1878·94	100·4	1·33	β	2 „

No. 536. Σ 2116.

R.A. 16h 54m 15s
Decl. + 63° 43′

1879·291	5°·0	19″·11	8·2...8·5	13 : 05	II.

The only other measures of this pair are by STRUVE. Probably fixed, as he found, 6°·0 : 18″·94 (1831·09).

No. 537. 20 *Draconis*. Σ 2118.

R.A. 16h 55m 49s
Decl. + 65° 13′

1879·592	209°·7	Distance not over 0″·2			V.
1880·627	217·7	0″·23	6·0...6·3	20 : 45	V.

This pair is now excessively close and difficult. I measured it twice at Madison in 1881. All the measures give:

1880·82	211°·3	0″·2	β	4 nights.

No. 538. ε *Ursæ Minoris*.

R.A. 16h 57m 15s
Decl. + 82° 14′

1879·274	6°·7	77″·08	...11·5	12 : 40	II.
1879·359	6·4	78·23	...11·0	12 : 35	II.
1879·32	6·5	77·65	...11·2		

The only other measures are in the Bedford Catalogue. SMYTH's results are: 358°·5 : 41″·0 (1835·55).

No. 539. Σ 2124.

R.A. 16h 58m 47s
Decl. + 65° 23′

1879·304	87°·7	14″·85	8·5...9·0	11 : 40	II.
1879·326	88·2	15·03	—	—	II.

I have measured this once before. The following are all the measures of this pair:

1832·27	88°·9	15″·06	Σ	3 nights.
1878·98	88·4	14·97	β	3 „

No. 540. 60 *Herculis*. ℍV. 133.

R.A. 16h 59m 49s
Decl. + 12° 54′

1879·345	310°·5	52″·84	5·0...10·0	15 : 00	II.

ℍ found, 307°·0 : 48″·97 (1783·2).

No. 541. η *Ophiuchi*. (SMYTH.)

R.A. 17h 3m 30s
Decl. − 15° 35′

1879·345	267°·4	256″·24	...10·8	15 : 40	II.
1879·414	267·5	256·86	...10·0	16 : 25	II.
1879·38	267·5	256·55	...10·4		

No other measures but SMYTH's.

No. 542. H. 589.

R.A. 17h 3m 28s
Decl. − 24° 47′

1880·465	302°·0	9″·93	7·5...7·8	17 : 30	II.

H. did not measure; called the magnitudes 9 and 11. In O. Arg. the principal star is 8m. STONE gives, 300°·7 : 9″·78 (1880·46).

No. 543. B.A.C. 5789. β 125.

R.A. 17h 4m 43s
Decl. − 26° 53′

1880·468	65°·2	1″·37	7·8...10·8	17 : 10	V.
1880·559	71·4	1·76	7·5...11·0	17 : 10	III.
1880·51	68·3	1·56	7·7...10·9		

A fine and rather difficult pair in the vicinity of 36 *Ophiuchi*. A short distance north is a much harder pair, suspected with the 6-inch at the time of the discovery of β 125. It will be found in the accompanying list of new pairs. The only other measures of β 125 are by STONE, 62°·8 : 1″·72 (1877·4) 2 n.

No. 544. 36 *Ophiuchi*. (SMYTH.)

R.A. 17h 7m 59s
Decl. − 26° 25′

A and C.

1879·345	305°·9	198″·03	...8·0	16 : 20	II.

No. 545. β 282.

R.A. 17h 8m 29s
Decl. − 14° 27′

1879·345	155°·2	3″·70	6·5...11·8	15 : 55	II.
1879·575	154·3	4·00	6·5...12·0	17 : 25	III.
1880·520	154·9	4·13·	5·5...11·0	16 : 30	II.

The principal star is strangely wanting in many of the Star Catalogues. In LAMONT'S zones it is called fifth magnitude. At Cin the larger component was suspected to be a close double, but I have not been able to detect any peculiarity in its appearance.

1875·41	154°·1	4″·23	De	3 nights.
1879·81	154·8	3·94	β	3 „
1881·42	151·7	4·41	β	4 „

No. 546. Σ 2146.

R.A. 17h 10m 27s
Decl. + 54° 16′

1879·291	225°·2	2″·84	8·3...10·0	12 : 45	II.

Apparently fixed.

No. 547. B.A.C. 5839. β 126.

R.A. 17h 12m 54s
Decl. − 17° 38′

A and B.

1879·507	259°·8	1″·47	6·5...8·0	16 : 05	III.
1879·581	262·9	1·01	6·5...8·0	—	
1879·54	261·3	1·24			

A and C.

1879·507	139°·8	11″·32	...11·8	16 : 10	III.
1879·581	139·6	11·71	...11·5	—	
1879·54	139·7	11·49			

The prior measures of the close pair are:

1875·11	261°·3	1″·74	De	5 nights.
1877·40	260·4	1·56	Cin	3 „

No. 548. Σ 2155.

R.A. 17h 14m 37s
Decl. + 60° 50′

1879·291	113°·5	9″·67	6·0...10·0	13 : 20	II.

Probably no change since STRUVE.

No. 549. *Ophiuchi* 221. Σ 2173.

R.A. 17h 24m 14s
Decl. − 0° 58′

1880·468	131°·3	0″·36	6·0...6·0	17 : 30	V.

One of the most interesting of the short period binaries. Some of the other late measures are:

1876·52	149°·3	0″·77	Hl	3 nights.
1879·22	137·0	0·69	Cin	16 „
1881·51	114·9	0·24	β	2 „

Dunér gives the following ephemeris, based upon a period of 45·43 years.

1876·43	147°·4	0″·78
1878·43	142·1	0·62
1880·43	131·8	0·40
1882·43	97·1	0·20
1884·43	21·8	0·25
1886·43	353·1	0·46
1888·43	344·8	0·68
1890·43	340·4	0·87

No. 550. Σ 2174.

R.A. 17h 24m 58s
Decl. + 32° 51′

1880·395	331°·4	5″·36	9·8...9·8	14 : 50	II.

Unchanged.

No. 551. Σ 2191.

R.A. 17h 33m 24s
Decl. − 4° 54′

1879·414	267°·7	26″·63	7·0...7·5	17 : 00	II.

Relatively fixed.

No. 551*a*. *Ophiuchi* 255. β 631.

R.A. 17h 33m 47s
Decl. − 0° 35′

1880·518	81°·7	0″·43	7·0...7·0	18 : 00	V.
1880·540	249·8	0·42	7·0...7·2	17 : 00	V.

From all the measures:

1879·55	73°·0	0″·40	β	4 nights.

No. 562. Oζ 340.

R.A. 17h 39m 53s
Decl. + 86° 58′

1879·326	233°·2	31″·64	7·8...8·2	11 : 30	II.

There appears to be some change in the angle:

1847·46	237°·2	31″·50	Oζ	3 nights.
1867·19	234·9	31·54	De	3 „

No. 553. μ *Herculis*. A.C. 7.

R.A. 17h 41m 47s
Decl. + 27° 48′

B and C.

1879·373	241°·9	0″·89	10·0...10·3	17 : 25	III.
1879·378	241·1	0·96	—	16 : 40	III.
1879·458	242·6	0·88	—	17 : 50	III.
1879·460	241·8	0·96	—	18 : 15	III.
1879·575	245·9	0·79	—	18 : 20	IV.
1880·392	244·7	0·82	—	15 : 30	III.
1880·395	245·1	1·04	—	15 : 00	II.
1880·455	244·4	1·10	—	15 : 40	III.
1880·460	246·4	0·82	—	16 : 50	V.
1880·473	246·8	1·04	—	15 : 15	III.
1880·551	247·4	0·92	—	18 : 15	III.
1880·589	246·5	0·99	—	16 : 35	V.

The mean results of all my measures of this interesting pair are as follows:—

1878·48	234°·9	1″·05	6 nights.
1879·45	242·7	0·90	5 „
1880·47	245·9	0·96	7 „
1881·41	252·1	0·92	5 „

No. 554. Σ 2225.

R.A. 17h 42m 26s
Decl. + 52° 0′

1879·301	313°·7	9″·05	9·0...9·1	13 : 15	II.
1879·490	313·3	9·06	9·0...9·2	15 : 40	III.

There would seem to be some change in the angle:

1830·25	319°·4	9″·07	Σ	4 nights.
1879·40	313·5	9·06	β	2 „

No. 555. 90 *Herculis.* β 130.

R.A. 17ʰ 49ᵐ 22ˢ
Decl. + 40° 3′

1879·471	118°·6	1″·76	...	14 : 10	II.

This measure was made when there was still enough daylight to see the wires, but the air was very unsteady. This pair was subsequently measured at Madison, as below. The following are all the other measures:

1875·52	123°·0	1″·82	De	6 nights	5·8...9·1
1881·46	122·2	1·90	β	4 „	6·0...9·7

No. 556. Σ 2247.

R.A. 17ʰ 52ᵐ 56ˢ
Decl. + 29° 29′

1879·315	189°·9	11″·42	8·0...9·5	—	II.
1880·395	190·2	11·60	8·8...9·1	15 : 20	II.
1879·85	190·0	11·51	8·4...8·8		

No sensible change.

No. 557. Bird.

R.A. 17ʰ 52ᵐ 55ˢ
Decl. + 67° 1′

A and B.

1879·291	329°·6	23″·01	8·4...8·5	13 : 45

B and C.

1879·291	333°·0	10″·15	...11·0	13 : 50	II.

A and C.

1879·291	147°·2	11″·87	—	13 : 55	II.

Noted in Argelander, 'Duplex, Class III.,' but the minute star between was detected by the late Mr. F. Bird. There are no other measures.

No. 558. γ *Draconis.* β 633.

R.A. 17ʰ 53ᵐ 49ˢ
Decl. + 51° 30′

A and B.

1879·274	151°·8	20″·90	...13·0	—	II.
1880·320	151·5	20·99	...13·5	15 : 10	II.

A and E.

1879·274	116°·3	124″·77	...10·8	—	II.

The distant star was observed by Smyth. There are several stars nearer, two of which, C and D, will be found in my first series of measures. The nearest companion is very minute. I know of no measures except my own, the mean of which is:

1879·09	151°·9	20″·91	β	4 nights.

No. 559. B.A.C. 6088. β 283.

R.A. 17ʰ 54ᵐ 38ˢ
Decl. − 22° 47′

1879·573	239°·5	7″·68	6·5...12·5	18 : 20	II.

From the mean of the measures of this unequal pair we have:

1878·86	239°·3	8″·05	β	3 nights.

No. 560. τ *Ophiuchi.* Σ 2262.

R.A. 17ʰ 56ᵐ 33ˢ
Decl. − 8° 11′

A and B.

1879·345	247°·1	1″·50	—	16 : 50	II.
1879·367	248·7	1·77	6·0...6·8	16 : 50	III.
1879·35	247·9	1·63			

A and C.

1879·345	127°·0	100″·07	—	16 : 40	III.
1879·367	126·8	100·53	...9·5	16 : 45	II.
1879·35	126·9	100·30			

The only prior measures of the distant star are by Smyth.

No. 561. β 418.

R.A. 18h 1m 28s
Decl. + 64° 26′

1879·291	47°·9	14″·33	8·2...12·0	14 : 10	II.

No other measures.

No. 562. 72 *Ophiuchi*. $O\Sigma$ 342.

R.A. 18h 1m 42s
Decl. + 9° 33′

1880·592	Certainly single; first-class night.	V.

I have carefully examined this star many times, and never at any time suspected the existence of any near companion, or any elongation in the bright star.

No. 563. 99 *Herculis*. A.C. 15.

R.A. 18h 2m 28s
Decl. + 30° 33′

1879·468	26°·5	1″·13	6·0...12·0	—	IV.
1880·455	30·1	0·70	6·0...10·5	15 : 10	IV.
1880·613	33·1	0·90	6·0...11·0	18 : 00	IV.

This pair is now extremely difficult to measure. Until recently it has been entirely neglected since shortly after its discovery. Flammarion has pointed out that the change in the position of the companion very nearly corresponds to the proper motion of the large star. On the whole it seems at least probable that it will prove to be a physical pair; but a few years' observations will determine this beyond question. The following are all the measures that have been made:

1859·63	347°·1	1″·71	Da	2 nights.	
1878·46	24·4	0·99	β	3 ,,	
1880·18	29·9	0·91	β	3 ,,	
1881·43	29·4	0·51	β	1 night.	Excessively dif.

No. 564. μ *Sagittarii*. H. 2289.

R.A. 18h 6m 35s
Decl. — 21° 5′

A and B.

1879·367	257°·7	16″·66	...11·0	17 : 00	II.

A and D.

1879·367	312°·1	48″·32	... 9·5	17 : 05	II.

A and E.

1879·367	115°·4	50″·13	... 9·5	17 : 10	II.

No. 565. β 131.

R.A. 18h 6m 42s
Decl. - 15° 38′

A and B.

1880·529	280°·0	2″·45	—	17 : 40	II.
1880·540	279·4	2·71	8·0... 9·5	17 : 30	II.

A and C.

1880·529	278°·3	7″·23	...12·0	17 : 45	II.
1880·540	279·1	7·03	...11·2	17 : 35	II.
1880·53	278·7	7·13	...11·6		

The close pair was found with the 6-inch, but the faint companion was not detected until the observations given

above. The following are all the measures of AB:

1875·01	278°·5	2″·71	De	4 nights.
1877·40	277·8	2·60	Cin	1 night.
1880·53	279·7	2·58	β	2 nights.
1880·58	279·6	2·71	Cin	1 night.

No. 566. Σ 2295. (8·4 and 10·6.)

R.A. 18h 8m 4s
Decl. + 31° 33′

1880·395	172°·2	10″·71	8·3...10·5	15 : 35	II.
1880·403	170·7	10·70	8·5...10·7	15 : 30	II.

There would seem to be no doubt of change in distance. The following, with the exception of an observation by MA., are all the measures:

1831·41	173°·9	11″·60	Σ	3 nights.
1879·31	173·1	10·22	Cin	1 night.
1880·40	171·4	10·70	β	2 nights.

No. 567. ΙΔ V. 93. (7·7 and 7·9.)

R.A. 18h 8m 24s ±
Decl. + 28° 14′

1880·395	136°·2	54″·80	7·6...8·0	15 : 50	II.
1880·403	136·4	54·76	7·8...7·8	15 : 00	II.
1880·406	136·7	55·09	—	15 : 25	III.

Apparently not a very interesting object, but as it has received no attention for nearly a century, it seemed worth re-observing. The following are all the measures:

1783·65	135°·7	47″·77	ΙΔ	1 night.
1880·40	136·4	54·88	β	3 nights.

No. 568. H. 2827.

R.A. 18h 9m 59s
Decl. − 19° 55′

1879·367	252°·0	20″·09	10·0...10·0	17 : 30	II.
1880·602	252·5	19·69	10·0...10·0	18 : 15	II.

A small and wide pair in a faint nebula. H. found the angle 254°·8, the estimated distance being 15″. The following are all the measures:

1879·46	253°·0	19″·82	β	3 nights.
1880·58	251·5	20·16	Cin	1 night.

No. 569. β 285.

R.A. 18h 9m 26s
Decl. − 25° 3′

A and B.

1880·468	315°·7	1″·75	8·8... 9·7	18 : 20	III.

C and D.

1880·468	20°·7	1″·65	9·5...10·5	18 : 25	III.

A and C.

1880·468	141°·0	59″·66	—	18 : 30	III.

A and C are O. Arg. 17953 and 17954 respectively. The angle of AB was measured in 1874·7, and found to be 317°·2. The only other measure is, Cin 316°·4 : 1″·34 (1877·60).

No. 570. β 246.

R.A. 18h 10m 33s
Decl. − 19° 43′

1880·468	102°·9	0″·49	7·8...7·8	18 : 45	V.

A very difficult pair. The other complete measures are:

1875·53	108°·7	0″·42	De	5 nights.
1881·59	110·0	0·47	β	3 „

No. 571.

R.A. 18h 12m 35s
Decl. + 56° 33′

A and B.

1879·291	239°·7	48″·10	7·0...	14 : 30	II.

B and C.

1879·291	4°·0	5″·28	11·0...11·5	14 : 25	II.

Star with distant double companion; not in any double-star catalogue.

No. 572. (SMYTH.)

R.A. 18h 12m 54s
Decl. − 17° 11′

1879·367	131°·7	24″·74	8·7...10·8	17 : 45	II.
1879·433	134·4	24·89	9·0...11·0	17 : 50	II.
1879·40	133·0	24·81	8·8...10·9		

One of the double stars of the Bedford Catalogue. SMYTH gives, 322°·0 : 35″·0 (1835·6).

No. 573. *η Serpentis.* Σ 8 App. II.

R.A. 18h 15m 6s
Decl. − 2° 56′

1879·367	67°·3	143″·56	...9·5	18 : 00	II.
1879·373	67·4	143·76	...9·5	17 : 00	II.

The change is due to the proper motion of the larger star, which is 0″·88 annually in the direction of about 318°.

1836·46	77°·2	112″·70	Σ	3 nights.
1866·49	69·7	134·06	De	4 „
1879·37	67·3	143·66	β	2 „

No. 574. *Herculis* 443. β 640.

R.A. 18h 16m 3s
Decl. + 27° 28′

1879·373	343°·0	2″·32	7·5...12·5	17 : 55	III.

The two measures I have made of this star give, 346°·2 : 2″·37 (1878·91).

No. 574*a*. β 641. (7·1 and 9·0.)

R.A. 18h 16m 43s
Decl. + 21° 27′

1880·518	350°·2	0″·99	6·8...9·0	18 : 20	V.
1880·526	352·4	1·12	7·0...8·5	17 : 50	IV.
1880·540	349·2	1·06	7·0...9·3	17 : 45	IV.
1880·553	347·0	0·82	7·0...9·3	17 : 35	IV.

The mean result of these and one prior measure is:

1880·12	349°·2	1″·00	β	5 nights.

No. 575. *φ Draconis.* Σ 353.

R.A. 18h 22m 30s
Decl. + 71° 16′

1879·473	57°·3	0″·60	—	15 : 00	IV.
1880·627	57·3	0·38	5·0...7·0	21 : 15	V.
1880·681	52·6	0·42	—	19 : 30	III.

There is very little change in this close and difficult pair since the first measures were made.

1856·13	63°·6	0″·56	Σ	6 nights.
1867·70	62·9	0·50	De	5 „
1878·59	52·2	0·39	Hl	8 „
1880·26	55·7	0·47	β	3 „
1881·55	58·7	0·43	β	6 „

No. 576. Σ 351.

R.A. 18h 22m 11s
Decl. + 48° 42′

1879·471	20°·0	0″·47	7·0...7·3	15 : 00	V.

The relative motion, if any, seems very slow:

1846·00	25°·0	0″·49	0 Σ	3 nights.
1867·69	30·6	obl.	De	5 „
1878·94	24·9	0·55	β	2 „

No. 576*a*. β 134 = *O* Σ 543.

R.A. 18h 22m 0s
Decl. + 46° 49′

1879·471	136°·1	0″·95	8·0...10·0	14 : 50	III.

De. gives, 134°·0 : 1″·07 (1875·00) 3 n.

No. 577. Σ 2322.

R.A. 18h 24m 8s
Decl. + 3° 59′

1879·499	168°·7	20″·15	7·0...11·0	18 : 35	II.

Very little change.

No. 578. (Smyth.)

R.A. 18h 24m 49s
Decl. − 19° 9′

Smyth gives for a pair in the cluster M 25, 149°·5 : 27″·0 (1836·60). I found no stars answering that description in this cluster. The star which agrees most nearly in place and magnitude is L 34207. This star has a distant companion, 252°·4 : 66″·60 : 8·0...9·3 (1879·345). In the field *s p* is a pair of 9 m. stars, 175° : 10″±. In the field *n p* are several 9–10 m. stars about equal distances from each other. Two of them were measured, 301°·3 : 30″·90 : 9·0...9·3 (1879·345).

No. 579. χ *Draconis*. (Smyth.)

R.A. 18h 23m 12s
Decl. + 72° 41′

1879·301	26°·1	144″·22	—	12 : 05	II.
1879·359	26·9	145·00	—	13 : 35	II.
1879·33	26·5	144·61			

The only earlier observations are in the 'Cycle.' There is a faint star near B, 315° : 8″.

No. 580. β 420.

R.A. 18h 25m 53s
Decl. + 37° 5′

A and B.

1880·416	277°·1	1″·67	8·5... 9·5	15 : 30	II.
1880·473	277·8	1·62	8·5...11·0	15 : 40	II.

A and C.

1880·416	198°·1	21″·58	...11·0	15 : 35	II.

The only measures of AB are:

1877·13	277°·0	1″·45	De	4 nights.
1880·44	277·4	1·64	β	2 „

No. 581. Σ 2335.

R.A. 18h 26m 27s
Decl. + 34° 11′

A and B.

1880·416	321°·7	11″·71	8·5...10·5	15 : 15	II.

A and C.

1880·416	151°·3	23″·67	... 9·5	15 : 20	II.

Probably unchanged.

No. 582. Σ 2340.

R.A. 18h 28m 30s
Decl. + 31° 30′

1880·406	103°·3	22″·76	—	15 : 45	III.

Very little change in the angle, but the distance is increasing: Σ 21″·51 (1830·43); De. 22″·32 (1864·50); Cin 22″·70 (1879·31).

No. 583. Σ 2341.

R.A. 18h 29m 21s
Decl. + 11° 21′

1880·578 265°·1 15″·38 8·7...9·3 18 : 15 II.

Relatively fixed.

No. 584. H. 864..

R.A. 18h 30m 34s
Decl. + 4° 52′

1880·610 321°·0 17″·65 7·0...11·5 18 : 25 II.

H. has no measure. The only measure prior to the one above is, Cin 321°·3 : 16″·42 (1879·39) 1 n.

No. 585. *Scutum Sob.* 45. β 135.

R.A. 18h 31m 16s
Decl. − 14° 6′

1879·589 183°·9 1″·45 7·0...12·0 —

This measure was made with the inferior micrometer belonging to the 6-inch, and is therefore probably incorrect in distance.

1875·08 184°·0 2″·45 De 4 nights.

No. 586. *O* Σ 360.

R.A. 18h 32m 44s
Decl. + 4° 45′

1880·551 289°·3 1″·23 6·8...10·5 18 : 30 III.

There does not appear to be any sensible change.

1849·67 292°·6 1″·11 O Σ 3 nights.
1867·16 291·3 1·40 De 4 „

No. 587. ♅ IV. 59.

R.A. 18h 32m 45s
Decl. + 38° 38′

1880·416 303°·5 29″·92 8·2...9·5 14 : 30 II.
1880·430 303·7 29·67 8·0...9·0 15 : 30 II.

A wide pair (=Σ 2354 *rej.*) near *Vega*. The only measures are nearly one hundred years apart, and show some variation in distance:

1783·81 303°·9 22″·33 ♅ 1 night.
1880·42 303·6 29·80 β 2 nights.

No. 588. Σ 2357.

R.A. 18h 32m 6s
Decl. + 63° 37′

1879·351 269°·5 4″·59 8·5...8·7 13 : 30 II.

Unchanged.

No. 589. α *Lyræ*. Σ 9 App. II.

R.A. 18h 32m 52s
Decl. + 38° 40′

1879·471 155°·5 48″·61 — — II.

Measured with daylight sufficient to see the wires.

No. 590. *Scutum Sob.* 46. Σ 2350 *rej.*

R.A. 18h 33m 30s
Decl. − 7° 54′

1879·345 17°·2 23″·43 6·5...12·0 — II
1880·703 16·5 23·10 6·5...11·0 18 : 45 II.

The only measures of this pair are:

1848·64 194°·8 24″·54 Mitchel 1 night.
1880·02 16·8 23·27 β 2 nights.

No. 591. 2 *Aquilæ*. ♅ V. 36.

R.A. 18h 35m 42s
Decl. − 9° 10′

1879·345 130°·1 52″·26 5·5...10·0 18 : 15 II.
1879·367 130·4 52·52 5·5...10·0 18 : 25 II.

Excluding the measures of SMYTH, the following are all the observations:

1781·57	—	42″·73	H	1 night.
1879·35	130°·2	52·39	β	2 nights.
1879·38	130·0	53·26	Cin	1 night.

No. 592. Σ 2367.

R.A. 18h 36m 39s
Decl. + 30° 11′

AB and C.

1880·395	193°·3	14″·18	7·0...8·3	16 : 05	II.
1880·403	193·1	14·07	7·0...8·3	15 : 15	II.
1880·40	193·2	14·12	7·0...8·3		

There is no change in the distant star. The seeing was too poor to measure the close pair.

No. 593. Σ 2378.

R.A. 18h 39m 5s
Decl. + 35° 26′

1880·403	190°·7	10″·98	8·3...8·8	14 : 35	II.

No change since STRUVE.

No. 594. Σ 2375.

R.A. 18h 39m 34s
Decl. + 5° 22′

1879·589	113°·3	1″·75	—	—	

Measured with the small micrometer mentioned in No. 595, and distance probably incorrect.

No. 595. *O* Σ (App.) 172.

R.A. 18h 40m 8s
Decl. + 33° 52′

1880·406	6°·3	65″·29	7·8...8·2	16 : 00	II.

The only other measures of the pair are:

1874·60	6°·1	65″·39	De	2 nights.

No. 596. 5 *Aquilæ*. Σ 2379.

R.A. 18h 40m 17s
Decl. − 1° 5′

A and B.

1879·345	121°·4	13″·08	6·0...7·5	17 : 50	II.
1880·703	121·2	13·01	5·6...7·5	19 : 00	II.
1880·02	121·3	13·05	5·8...7·5		

A and C.

1879·345	145°·2	27″·25	...11·5	17 : 55	II.
1880·703	145·7	27·82	...11·0	19 : 05	II.
1880·02	145·5	27·53	...11·2		

No. 597. 110 *Herculis*.

R.A. 18h 40m 30s
Decl. + 20° 26′

A and B.

1879·296	95°·5	44″·70	—	14 : 45	II.

A and C. (H. 2839.)

1879·296	92°·3	61″·16	—	14 : 35	II.
1879·573	91·8	61·07	...11·0	19 : 15	II.

The faint star B, between the principal star and H.'s companion, has not been seen before. Rejecting SMYTH's observations, the only measures of the old companion are:

1879·34	91°·5	61″·07	Cin	2 nights.
1879·43	92·0	61·16	β	2 „

No. 598. H VI. 50.

R.A. 18h 43m 15s
Decl. − 6° 3′

A and B.

1879·367	356°·8	22″·53	...13·0	18 : 05	II.

A and C.

1879·345	170°·4	114″·11	6·7...8·0	18 : 30	II.
1879·367	170·6	113·86	—	18 : 10	II.
1879·35	170·5	113·98			

The faint star B was first noted with the 6-inch. There are no other measures of the HERSCHEL star except SMYTH'S.

No. 599. *ν Lyræ.* H V. 40.

R.A. 18h 45m 18s
Decl. + 32° 40′

A and B.

1879·296	70°·2	36″·46	...11·5	15 : 40	II.
1879·359	70·8	36·01	...11·5	15 : 10	II.
1879·33	70·5	36·24	...11·5		

A and C.

1879·296	122°·1	58″·65	...10·5	15 : 35	II.
1879·359	122·4	58·51	...10·5	15 : 15	II.
1879·33	122·2	58·58	...10·5		

C and D.

1879·296	212°·9	18″·23	...11·5	15 : 45	II.
1879·359	212·3	17·52	...12·0	15 : 20	II.
1879·33	212·6	17·87	...11·7		

The only earlier measures, except SMYTH'S, are of AC by SOUTH, 124°·0 : 59″·84 (1825·61).

No. 600. *β Lyræ.*

R.A. 18h 45m 39s
Decl. + 33° 13′

A and D.

1879·296	317°·7	66″·02	...9·3	15 : 10	II.
1879·359	317·7	66·49	...9·0	14 : 50	II.
1879·33	317·7	66·25	...9·2		

A and E.

1879·296	19°·1	85″·95	...9·0	15 : 00	II.
1879·359	18·6	85·61	...9·0	14 : 45	II.
1879·33	18·8	85·78	...9·0		

There are no other measures of these stars except such as are found in the Bedford Catalogue.

No. 601.

R.A. 18h 45m 52s
Decl. + 10° 10′

1879·433	24°·3	22″·08	8·5...8·7	18 : 10	II.
1879·545	24·6	22·01	—	18 : 45	II.
1879·49	24·5	22·05			

This star is given in H.'s measures with the small refractor, but with an error of about 5m R.A. H. 22°·5 : 24″·20 (1828·6).

No. 602. H. 870.

R.A. 18h 45m 54s
Decl. + 10° 12′

1879·433	218°·8	11″·31	9·5...10·8	18 : 05	II.
1879·545	218·6	11·23	—	18 : 35	II.
1879·49	218·7	11·27			

Early observations are found in the Bedford Catalogue, 220°·0 : 6″·5 (1833·57), but the place of the star at least is erroneous. In his observations of No. 611, H. refers to this pair and gives 215°·0 : 8″·42 (1828·6). If the distance is correct, there has been considerable change. The appearance of the pair would not lead one to expect motion. Cin 218°·7 : 11″·35 (1879·54) 2 n.

No. 603. *β* 137.

R.A. 18h 49m 48s
Decl. + 37° 14′

A and B.

1880·416	128°·8	″ —	—	—	II.
1880·473	126·9	1·10	8·3...8·5	16 : 30	III.

A and C.

1880·473	142°·0	17″·92	...11·5	16 : 35	III.

No other measures of the faint companion. Of AB we have:

1875·58	123°·8	1″·15	De	4 nights.
1875·68	123·9	1·15	Shp	4 „

No. 604. Σ 2414.

R.A. 18h 50m 6s
Decl. − 0° 58′

1880·526	277°·3	17″·03	8·0...10·5	18 : 50	II.
1880·534	277·7	17·30	8·5...10·5	—	II.
1880·53	277·5	17·16	8·2...10·5		

Unchanged.

No. 605. *Lyræ* 91. OΣ 525.

R.A. 18h 50m 28s
Decl. + 33° 49′

A and B.

1880·589	126°·9	1″·84	7·0...10·8	17 : 00	III.

A and C. (Sh. 282.)

1880·406	350°·5	45″·21	—	16 : 15	II.
1880·589	350·7	45·42	...8·5	17 : 05	III.
1880·49	350·6	45·31			

No change in the distant star, and very little, if any, in the close companion.

1849·70	128°·0	1″·55	OΣ	7 nights.
1869·77	132·8	1·36	De	2 „

No. 606. Σ 2421.

R.A. 18h 51m 37s
Decl. + 33° 38′

1880·406	66°·4	22″·72	—	16 : 25	II.
1880·416	64·8	22·16	8·5...9·0	14 : 50	II.
1880·430	64·7	22·19	8·5...9·2	15 : 40	II.
1880·589	65·8	22·32	8·2...8·7	17 : 15	III.

A steady increase in the distance, with some change in the angle, probably due to proper motion. The following are all the measures:

1829·25	68°·8	21″·15	Σ	2 nights.
1864·92	66·3	21·99	De	2 „
1880·46	65·4	22·46	β	4 „

No. 607. OΣ 365.

R.A. 18h 52m 20s
Decl. + 44° 4′

A and B.

1880·592. Large star single. First-class conditions. V.

On many occasions I have been unable to detect any elongation. It is probably a short-period binary, but there are no measures of it in the last twenty-five years.

No. 608. B.A.C. 6480. β 648.

R.A. 18h 52m 30s
Decl. + 32° 45′

1879·468	298°·3	0″·66	6·5...9·0	16 : 40	IV.

A difficult pair near γ *Lyræ*. Heis gives it 6 m. The mean of my three measures, the angles of which are not very accordant, is, 307°·8 : 0″·62 (1878·80) 3 n.

No. 609. γ *Lyræ*. (Smyth.)

R.A. 18h 54m 27s
Decl. + 32° 31′

1879·296	20°·9	119″·44	...10·5	15 : 20	II.

A distant star of Smyth's Cycle. There are several stars, besides the OΣ companion, nearer than this.

No. 610. ζ *Sagittarii*. (Winlock.)

R.A. 18h 55m 0s
Decl. − 30° 3′

1880·613	61°·7	0″·54	3·5...4·0	18 : 35	V.
1880·625	62·6	0·56	—	17 : 20	V.

A very difficult pair in this latitude, and probably in rapid motion. The following are all the measures:

1867·8	260°·8	0″·48	Ne	1 night.	
1878·70	84·2	0·42	β	1 „	
1879·71	54·8	0·3±	β	1 „	with 6-inch.
1880·62	62·1	0·55	β	2 nights.	
1881·61	36·1	0·31	β	2 „	

No. 611. Σ 2436.

R.A. 18h 56m 24s
Decl. + 8° 35′

1880·578	310°·2	33″·19	8·0...8·6	18 : 50	II.
1880·581	310·2	32·82	8·0...8·5	19 : 00	II.
1880·58	310·2	33·00	8·0...8·5		

Distance diminishing.

No. 612. Σ 2434. (8·3, 8·9, and 9·9.)

R.A. 18h 56m 34s
Decl. − 0° 53′

B and C.

1880·468	64°·9	1″·60	9·0... 9·8	19 : 40	III.
1880·602	64·5	1·34	9·0...10·5	18 : 45	III.
1880·689	65·2	1·44	8·7... 9·5	19 : 00	II.
1880·59	64·9	1·46			

A and B.

1880·602	131°·9	23″·58	...8·3	18 : 50	III.
1880·689	131·8	24·10	...8·3	19 : 05	II.
1880·64	131·8	23·84			

No. 613. 16 *Lyræ*. H. 1362.

R.A. 18h 58m 3s
Decl. + 46° 46′

1879·315	275°·9	42″·30	6·0...11·5	16 : 10	II.
1879·351	276·6	41·56	6·0...11·5	15 : 00	II.
1879·33	276·3	41·93	6·0.. 11·5		

The only prior measures are by SMYTH.

No. 614. ζ *Aquilæ*. β 287.

R.A. 18h 59m 54s
Decl. + 13° 41′

1879·430	59°·3	4″·48	—	18 : 25	III.
1879·573	61·5	4·68	—	19 : 30	II.
1879·575	60·4	4·84	...13·0	19 : 25	II.
1880·551	59·1	4·94	—	18 : 45	II.

The following are the principal measures of this fine pair:

1878·54	59°·6	4″·92	β	3 nights.
1879·08	61·0	5·55	Hl	4 „
1879·53	60·1	4·74	β	4 „

A distant 10 m. star, measured by SMYTH, was also observed: 76°·9 : 156″·65 (1879·342) 1 n.

No. 615. Σ 2446.

R.A. 18h 59m 56s
Decl. + 6° 22′

1880·586	153°·1	9″·78	6·5...8·0	17 : 00	II.

Unsteady. Probably unchanged.

No. 616. DE. 19.

R.A. 19h 5m 52s
Decl. + 55° 8′

A and B.

1879·471	26°·1	0″·57	8·3...9·0	15 : 25	V.

AB and C. (Σ 2479.)

1879·471	33°·4	6″·70	...9·5	15 : 30	V.

The close pair was discovered by DE. in 1863, and is undoubtedly in slow retrograde motion, as DE. found the angle 40°·8 (1863·87), and 36°·8 (1870·83). The angle of the Σ companion seems slowly decreasing also.

No. 617. ℍ V. 42.

R.A. 19h 9m 24s
Decl. + 38° 50′

1879·315	57°·3	39″·59	8·0...8·3	15 : 30	II.

Probably fixed. The following are all the other measures:

1782·46	63°·7	38″·13	ℍ	1 night.
1823·46	57·7	40·39	Sh	2 nights.
1879·52	56·4	39·76	Cin	4 „

No. 618. ℍ V. 77.

R.A. 19h 11m 10s
Decl. − 19° 5′

1879·367	159°·3	39″·54	7·3... 9·0	18 : 40	II.
1879·463	158·6	40·20	8·0...10·0	18 : 40	II.
1879·41	159·0	39·87	7·6... 9·5		

The only measure besides Smyth's is, ℍ 168°·7 : 36″·05 (1783·62) 1 n.

No. 619. *Cygni* 9. Σ 2496.

R.A. 19h 12m 10s
Decl. + 49° 52′

1879·493	79°·2	2″·31	6·7...10·0	15 : 40	III.

Ma. is the only prior observer of this pair since Σ. Probably unchanged.

No. 620. 2 *Vulpeculæ*. β 248.

R.A. 19h 12m 39s
Decl. + 22° 49′

1879·430	127°·8	1″·89	6·0...9·5	18 : 45	III.

The only other measures are:

1875·62	125°·0	1″·83	De	4 nights.

No. 621. 23 *Aquilæ*. Σ 2492.

R.A. 19h 12m 26s
Decl. + 0° 52′

1880·689	11°·6	3″·33	6·0...8·5?	18 : 40	II.

Unchanged.

No. 622. δ *Draconis*.

R.A. 19h 12m 30s
Decl. + 67° 27′

A and B.

1879·351	354°·3	90″·35	...12·0	14 : 00	II.

A and C. (Smyth.)

1879·351	27°·8	155″·45	...10·5	13 : 55	II.
1879·359	27·7	154·74	...10·8	12 : 55	II.
1879·35	27·8	155·10			

B has not been observed before, and C only by Smyth.

No. 623. Σ 3131.

R.A. 19h 16m 29s
Decl. + 38° 57′

1879·315	305°·4	9″·57	8·8...9·5	15 : 45	II.

Fixed.

No. 624. δ *Aquilæ*. (Smyth.)

R.A. 19h 19m 46s
Decl. + 2° 52′

1879·342	271°·7	101″·71	...11·0	—	II.
1879·367	272·0	100·96	...10·5	18 : 50	II.
1879·35	271·8	101·34	...10·7		

No. 625. Σ 2530.

R.A. 19h 23m 9s
Decl. + 20° 5′

1880·473	156°·4	5″·50	9·0...9·5	17 : 25	II.

Fixed.

No. 626. De. 21.

R.A. 19h 25m 1s
Decl. − 2° 22′

A and B.

1880·602	71°·0	1″·17	7·6...9·0	19 : 45	III.

A and C. (Σ 2535.)

1880·602	297°·9	26″·69	...9·0	19 : 50	III.

The close star was discovered by De. in 1865. So far there is no evidence of change. De. found, 70°·0 : 1″·22 (1865·76). Later measures of the Σ star make the distance less:

1831·54	297°·7	27″·78	Σ	2 nights.
1865·64	298·1	26·31	De	3 „
1879·54	298·0	26·70	Cin	7 „

No. 627. β 438.

R.A. 19h 27m 3s
Decl. + 36° 27′

A and B.

1879·468	40°·9	4″·37	8·5...13·0	17 : 35	III.

C and D.

1879·468	51°·9	5″·93	8·7...8·7	17 : 40	III.

A and C.

1879·468	247°·7	46″·82	—	17 : 45	III.

The three bright stars make Σ 2538. There is a minute star between A and C, 238°·5 : 21″·09 (1878·47) 1 n.

No. 628. β 652.

R.A. 19h 27m 16s
Decl. + 28° 1′

A and B.

1879·458	328°·4	3″·89	...13·0	—	II.

A and C. (Σ 2539.)

1879·458	3°·8	5″·46	—	—	II.
1879·468	3·9	5·55	8·0...9·0	17 : 00	III.

The four measures I have made of the old star give 3°·8 : 5″·60 (1878·73), from which it would appear there has been no change since the measures of Σ. The previous measure of the new companion differs in distance from the last observation, the two giving 328°·6 : 4″·33 (1878·97).

No. 629. OΣ 374 *rej.*

R.A. 19h 27m 51s
Decl. + 49° 57′

1879·493	297°·7	18″·39	7·5...10·8	15 : 30	II.

Without change.

No. 630. β 144.

R.A. 19h 33m 3s
Decl. + 30° 5′

1880·430	352°·1	6″·24	8·7...8·8	16 : 50	II.

The only other measures are:

1875·37	171°·0	6″·34	De	4 nights	8·9...8·9

No. 631. Σ 2557.

R.A. 19h 34m 49s
Decl. + 29° 28′

A and B.

1880·430	104°·1	11″·13	8·3...10·0	17 : 25	II.

A and C. (β 54.)

1880·430	301°·5	21″·12	...10·5	17 : 30	II.

The faint star is not in Σ. My two measures give, 302°·5 : 21″·03 (1879·45). The following are substantially all the measures of AB:

1831·78	104°·7	11″·42	Σ	3 nights.
1867·71	104·5	11·14	De	2 „
1879·45	103·6	10·94	β	2 „

No. 632. β 145.

R.A. 19h 36m 31s
Decl. + 30° 26′

AB and C.

1878·430	32°·6	8″·51	7·5...13·0	17 : 10	II.

AB and D.

1878·430	157°·3	26″·67	...10·8	17 : 15	II.

The foregoing are all the measures of the two faint companions. Of AB we have:

1875·13	268°·2	0″·87	De	4 nights	6·8...9·5

No. 633. A.G.C. 10.

R.A. 19h 39m 15s
Decl. + 10° 29′

A and B.

1879·575	149°·5	0″·32	8·0...8·0	20 : 05	V.
1880·468	150·7	0·30	8·0...8·0	19 : 25	V.
1880·627	142·7	0·26	—	18 : 15	V.

This is the principal star of Σ 2570, close pair, discovered by ALVAN G. CLARK in 1875. There is no change in the Σ companion. The following are all the measures of AB:

1878·35	145°·5	0″·29	β	3 nights.
1880·22	147·6	0·29	β	3 „

No. 634. β 146.

R.A. 19h 40m 6s
Decl. − 20° 10′

1879·575	301°·8	0″·91	8·3...9·0	19 : 50	II.

In a low-power field, with 56 *Sagittarii*. The only other measure is, Cin. 295°·8 : 0″·98 (1879·64) 1 n.

No. 635. γ *Aquilæ*. (SMYTH.)

R.A. 19h 40m 33s
Decl. + 10° 19′

1879·315	257°·4	132″·24	...11·0	18 : 00	II.
1879·523	258·0	132·93	—	—	II.
1879·42	257·7	132·58			

The only other measures are by SMYTH. A more distant 10·5m star was inadvertently measured on one occasion for this, 233°·0 : 217″·54 (1879·43). There are other stars nearer than the SMYTH companion.

No. 636. ζ *Sagittæ*. A.G.C. 11.

R.A. 19h 43m 39s
Decl. + 18° 51′

A and B.

1879·430	154°·1	0″·32	—	—	V.
1880·559	156·1	0·29	5·5...6·5	19 : 35	V.
1880·627	149·8	0·31	—	18 : 20	V.

There is no change in the distant star (Σ 2585). The close pair is a very difficult object. The following are all the measures that have been made:

1878·11	157°·6	0″·29	β	5 nights.
1880·20	153·3	0·31	β	3 „

No. 637. 56 *Aquilæ*. H. 900.

R.A. 19h 47m 37s
Decl. − 8° 53′

1879·507	78°·8	46″·92	6·0...11·8	—	II.
1880·742	76·8	46·40	5·5...11·7	19 : 45	II.
1880·12	77·8	46·66	5·7...11·8		

No. 638. 57 *Aquilæ*. Σ 2594.

R.A. 19h 48m 8s
Decl. − 8° 32′

1879·578	172°·3	—	6·5...6·8	18 : 45	
1880·744	171·1	35·61	—	20 : 20	II.

Unchanged.

No. 639. *Aquilæ* 191. Σ 2597.

R.A. 19h 48m 53s
Decl. − 7° 3′

1880·775	88°·6	1″·23	7·5...8·0	19 : 30	II.

Distance decreasing?

No. 640. β *Aquilæ*. OΣ 532.

R.A. 19h 49m 25s
Decl. + 6° 7′

1879·342	14°·6	11″·82	...12·0	16 : 35	II.
1879·433	15·1	11·62	...12·0	18 : 55	II.
1880·689	16·3	11·71	...11·8	19 : 35	I.
1880·775	16·9	11·86	...12·0	19 : 40	II.

Very little relative change, but the two stars have a common proper motion.

1852·44	17°·1	12″·36	OΣ	4 nights.
1868·10	17·8	11·98	De	4 „
1878·61	16·5	12·00	β	3 „
1880·06	15·7	11·75	β	4 „
1881·43	17·2	12·25	β	4 „

The following measures relate to a distant star measured by Smyth:

1879·342	347°·3	151″·66	...10·5	16 : 40	II.
1879·367	347·2	151·77	...10·0	19 : 05	II.
1879·433	346·9	152·24	...10·5	18 : 50	II.
1879·38	347·1	151·89	...10·3		

No. 641. β 425.

R.A. 19h 52m 15s
Decl. + 19° 58′

A and B.

1879·548	239°·9	1″·59	8·3...8·3	17 : 15	IV.
1880·473	243·5	1·32	8·3...8·6	17 : 00	III.

A and C.

1879·548	39°·6	20″·13	...12·0	17 : 20	IV.
1880·473	42·2	19·70	...11·8	17 : 05	III.

My three measures of the faint star give, 40°·4 : 19″·81 (1879·55). The following are all the measures of the close pair:

1876·30	241°·3	1″·26	De	3 nights.
1879·55	241·2	1·41	β	3 „

No. 642. 16 *Vulpeculæ*. OΣ 395.

R.A. 19h 56m 56s
Decl. + 24° 36′

1879·548	96°·6	0″·63	6·0...6·0	17 : 40	V.
1880·556	90·2	1·06	5·5...5·8	19 : 15	III.
1880·05	93·4	0·84			

Very little change.

No. 643. Σ 2619.

R.A. 19h 57m 29s
Decl. + 47° 56′

A and B.

1879·493	243°·3	4″·26	8·0...8·0	16 : 00	II.

C and D.

1879·493	183°·8	5″·45	11·8...13·0	16 : 10	II.

A and C.

1879·493	295°·9	18″·55	—	16 : 05	II.

The brighter components remain fixed, but the distance of C appears to be increasing. The faint companion to C was discovered by OΣ in 1854, but not measured at Pulkowa. The above is the only measure I have seen of CD.

No. 644. a^1 *Capricorni*. H. 607.

R.A. 20h 11m 0s
Decl. − 12° 53′

1879·433	221°·3	44″·52	...9·0	18 : 25	II.
1879·463	221·2	44·09	...9·0	19 : 15	II.
1879·578	220·9	44·35	—	—	
1879·49	221·1	44·32	...9·0		

A distant star given in the Bedford Catalogue. The only reliable early measure is, Da. 220°·1 : 44″·14 (1830·56) 1 n.

No. 645. α^2 *Capricorni*. A.G.C. 12.

R.A. 20h 11m 24s
Decl. − 12° 55′

B and C.

1879·575	240°·1	0″·77	12·0...12·0	—	
1880·594	239·2	1·16	11·0...11·1	18 : 45	III.

A and D.

1879·433	156°·4	154″·39	...9·5	18 : 30	II.
1879·463	156·1	154·47	...9·5	19 : 25	III.
1879·45	156·2	154·43	...9·5		

The distant star given by Smyth, 155°·7 : 198″·0 (1838·72).

No. 646. β 441.

R.A. 20h 12m 37s
Decl. + 28° 46′

1880·473	65°·7	5″·67	6·5...11·5	18 : 50	II.

The only other measures are:

1877·39	66°·9	5″·78	De	3 nights.

No. 647. Smyth.

R.A. 20h 19m 45s
Decl. + 38° 7′

1879·315	295°·1	66″·27	8·5...8·8	17 : 20	II.

There is a star 11m nearer than the Cycle star, 319°·2 : 38″·62 (1879·315). Smyth found, 299°·5 : 55″·0 (1835·48).

No. 648. S. 749. (7·1 and 7·4.)

R.A. 20h 21m 14s
Decl. − 2° 30′

1880·698	190°·1	59″·68	7·5...7·8	19 : 30	II.
1880·744	189·6	59·54	6·8...7·0	20 : 30	II.

Evidently fixed. The following are all the measures:

1825·00	189°·4	59″·87	S	3 nights.
1880·72	189·8	59·61	β	2 „

No. 649. 1 *Delphini*. β 63.

R.A. 20h 24m 33s
Decl. + 10° 30′

1879·430	341°·9	1″·02	6·5...8·0	14 : 40	III.
1880·559	346·3	0·77	6·3...7·5	19 : 50	V.
1880·597	348·0	0·84	6·5...8·3	20 : 00	V.

The principal measures of this fine pair are:

1874·92	342°·3	0″·84	De	4 nights	6·0...8·1
1880·19	345·4	0·88	β	3 „	6·4...7·9

No. 650. *Vulpeculæ* 94. Σ 2695.

R.A. 20h 26m 50s
Decl. + 25° 24′

1879·893	81°·1	1″·00	6·5...8·0	—	III.

No. 651. P. XX. 177. *O* Σ 407.

R.A. 20h 25m 29s
Decl. + 10° 51′

1879·430	211°·5	0″·51	—	—	V.

No. 652. Σ 2696.

R.A. 20h 27m 34s
Decl. + 5° 2′

1880·610	306°·6	0″·98	8·0...8·0	18 : 45	III.

Unsteady. A faint star, 12 m., was noticed, 340° : 15″.

No. 653. β 671.

R.A. 20h 29m 34s
Decl. + 62° 3′

1879·490	333°·9	0″·42	7·5...9·0	16 : 05	III.

The following are all the measures of this difficult pair:

1877·90	335°·9	0″·47	De	1 night.
1879·54	334·0	0·45	β	3 nights.

No. 654. β *Delphini*. β 151.
(4·2, 6·0, 12·7, and 11·0.)

R.A. 20h 31m 55s
Decl. + 14° 11′

A and B.

1879·545 If any elongation, in 90°, but very doubtful. V.
1879·575 No certain elongation. First-class night.

1880·594	139°·5	0″·28	—	19 : 15	V.
1880·613	129·4	0·22	—	19 : 30	V.
1880·627	127·1	0·30	—	18 : 35	V.
1880·766	129·0	0·24	—	19 : 55	V.
1880·782	142·9	0·27	—	20 : 00	V.

AB and C.

1880·460	114°·7	27″·56	—	17 : 50	III.

AB and D. (= Σ 2704.)

1880·460	335°·6	35″·52	—	17 : 55	V.

A most interesting and rapid binary system, and deserving of special attention, but too difficult now for inferior instruments. Subsequent measures show that the large star could not have been really single in 1879, but the distance was probably about the minimum near that time. The following are the principal measures each year since its discovery with the 6-inch in 1873:

1874·66	15°·6	0″·61	De	5 nights.
1875·65	20·1	0·54	De	4 nights.
1876·66	25·8	0·48	De	4 „
1877·79	40·8	0·32	β	4 „
1878·65	53·7	0·24	β	4 „
1879·56	Elongation doubtful		β	2 „
1880·68	133·6	0·26	β	5 „
1881·50	149·2	0·26	β	5 „
1882·60*	167·5	0·26	β	3 „
1883·55	182·5	0·23	β	3 „

The fainter star, C, first noted by H., is not in STRUVE. H. gave the angle 107°·7. The only measures are my own, which are as follows, the one given above being combined with three later measures:

1878·05	116°·2	27″·66	β	3 nights.
1881·19	115·6	27·57	β	4 „
1883·54	116·2	27·43	β	1 night.

The change in the STRUVE companion is due to proper motion. Some of the measures are:

1829·40	343°·8	32″·48	Σ	3 nights.
1869·94	336·6	34·64	De	3 „
1880·49	334·7	35·40	β	5 „
1883·54	334·2	35·52	β	1 night.

No. 655. 1 *Aquarii*. H. 2984.

R.A. 20h 33m 16s
Decl. + 0° 4′

A and B.

1879·433	217°·3	56″·35	...11·5	19 : 25	II.
1879·463	217·4	55·39	...11·5	19 : 00	II.
1879·45	217·4	55·87	...11·5		

A and C.

1879·433	38°·9	72″·97	...11·3	19 : 35	II.
1879·403	38·9	72·82	...11·3	19 : 35	II.
1879·45	38·9	72·90	...11·3		

No. 656. κ *Delphini*. O Σ 533.

R.A. 20h 33m 17s
Decl. + 9° 40′

* For details of later measures, 1882-3, see Appendix.

1879·573	328°·5	10″·79	...12·0	20 : 30	II.
1880·460	324·1	11·07	...12·0	18 : 15	II.
1880·689	325·3	10·52	...11·8	19 : 20	I.
1880·692	326·5	11·25	...11·8	20 : 05	I.
1880·744	325·0	11·06	...12·0	20 : 05	II.

The principal later measures are:

1868·10	345°·7	9″·41	De	3 nights.
1878·18	329·2	10·59	β	4 „
1880·43	325·9	10·93	β	5 „
1881·44	324·2	11·27	β	3 „

No. 657. *a Delphini.*

R.A. 20ʰ 34ᵐ 3ˢ
Decl. + 15° 29′

A and C. (H. 1554.)

1879·315	279°·8	42″·38	...11·0	17 : 50	II.

A and F. (SMYTH.)

1879·315	113°·8	80″·44	...10·8	17 : 45	II.
1879·367	113·9	80·90	—	19 : 20	II.
1879·34	113·8	80·67	...10·8		

The only other measures of the very distant star are in the Bedford Catalogue, but the distance there is much too large. The mean of my three measures of C is, 279°·8 : 42″·29 (1878·62) 3 n.

No. 658. Σ 2709.

R.A. 20ʰ 34ᵐ 14ˢ
Decl. + 21° 18′

1880·556	310°·5	9″·08	8·5...9·2	18 : 55	II.
1880·698	311·5	9·40	8·5...9·3	20 : 05	II.
1880·63	311·0	9·24	8·5...9·2		

Probably unchanged.

No. 659. *O* Σ 409.

R.A. 20ʰ 34ᵐ 14ˢ
Decl. + 3° 1′

1880·698	83°·4	16″·82	6·8...9·3	19 : 50	II.

Unchanged.

No. 660. Σ 2714.

R.A. 20ʰ 35ᵐ 17ˢ
Decl. + 29° 20′

1879·526	340°·1	6″·38	8·5...12·0	18 : 10	II.
1880·772	340·3	6·42	8·0...10·5	20 : 40	II.

Probably unchanged, though I make the angle a little larger than Σ:

1831·83	336°·2	6″·82	Σ	3 nights.
1879·58	340·8	6·56	β	3 „

No. 661. *a Cygni.* ♅ N. 73.

R.A. 20ʰ 37ᵐ 20ˢ
Decl. + 44° 51′

1879·315	106°·2	75″·85	1·5...11·5	16 : 30	II.
1879·351	105·8	75·41	...11·5	15 : 30	II.
1879·400	105·9	75·09	...11·3	16 : 50	II.
1879·35	106·0	75·45	...11·4		

No. 662. λ *Cygni.* *O* Σ 413.

R.A. 20ʰ 42ᵐ 44ˢ
Decl. + 36° 3′

A and B.

1879·468	77°·7	0″·71	5·0...7·0	18 : 30	V.
1880·581	83·8	0·83	5·0...7·0	19 : 30	V.

AB and C. (S. 765.)

1880·485	105°·3	85″·14	...8·7	18 : 30	II.
1880·567	105·2	84·92	—	19 : 05	II.
1880·52	105·2	85·03			

For the distant star S. gives 104·5 : 85″·59 (1825·08) 3 n.

No. 663. *η Cephei.* (SMYTH.)

R.A. 20ʰ 42ᵐ 54ˢ
Decl. + 61° 22′

1879·351	33°·5	100″·20	3·5...11·5	14 : 20	II.
1879·359	34·1	100·89	...11·0	14 : 00	II.
1879·35	33·8	100·54	...11·2		

The only other measures are SMYTH's, 29°·0 : 45″·0 (1834·74).

No. 664. χ *Delphini*. H. 1592.

R.A. 20h 49m 55s
Decl. + 12° 6′

1879·499	21°·5	40″·03	...12·0	19 : 00	II.
1879·509	22·1	39·91			
1879·50	21·8	39·97			

H. gives the angle 22°·0. The only other measures are in the Bedford Catalogue.

No. 665. β 764.

R.A. 20h 52m 22s
Decl. − 9° 49′

A and B.

1880·551	354°·4	0″·90	9·0...9·2	20 : 00	III.

AB and C.

1880·551	112°·9	99″·62	...9·0	20 : 05	III.

AB and D.

1880·551	21°·6	137″·45	...9·0	20 : 10	III.

Discovered at Mount Hamilton with the 6-inch. The only other measures are those made at that place. The distances are uncertain in consequence of the imperfect micrometer used.

No. 666. *O* Σ 424.

R.A. 20h 53m 39s
Decl. + 15° 6′

1879·575	325·5	0″·33	8·0...9·0	21 : 20	IV.

A difficult pair, and probably a rapid binary. If so, it must have moved through an entire revolution in the last thirty years. DE. thought it might be elongated in the direction of 330° in 1865, but doubtful. I found it apparently round with the 6-inch in 1876. Still, it is a difficult object, and it may be that no change at all has taken place:

1848·34	325°·5	0″·43	*O* Σ	3 nights.
1879·10	326·6	0·39	β	2 „

No. 667. L. 40682.

R.A. 20h 54m 58s
Decl. + 18° 52′

1880·556	332°·8	44″·84	6·0...8·7	19 : 40	III.
1880·698	332·6	44·49	6·5...8·8	20 : 25	II.
1880·63	332·7	44·66	6·2...8·7		

A wide pair; not in any double-star catalogue.

No. 668. 59 *Cygni*. (AB=Σ 2743.)

R.A. 20h 55m 44s
Decl. + 47° 3′

A and C.

1879·351	140°·6	26″·73	...11·5	16 : 00	II.

This star, first noted by H., was not measured by STRUVE. SMYTH gives, 142°·0 : 30″·0 (1836·72).

No. 669. β 158.

R.A. 21h 1m 37s
Decl. + 47° 19′

1879·567	314°·5	10″·72	8·5...12·5	17 : 40	II.

This pair is in the field with a new double nebula, found at the same time with the 6-inch. The nebula and a 9·5 m.

star near it were measured, 243°·8 : 25″·25 (1879·567). The only other measures are:

1875·72	314°·9	10″·44	De	3 nights	7·3...11·8

No. 670. *O Σ* 527.

R.A. 21ʰ 2ᵐ 1ˢ
Decl. + 4° 40′

1880·813	293°·9	0″·34	7·0...8·5	20 : 15	V.

O Σ thought this pair might be in rapid movement from the three Pulkowa measures, and FLAMMARION suggests a period of about 54 years, based upon angular motion of 207° in 31 years. To get this, he has applied a correction of 180° to the angle found by my first series of measures, DE. having given the position angle in that quadrant. I think this is a mistake, as I have expressly noted that the smaller component is preceding. With the aperture used by DE., the difference in magnitude would not be very apparent. O Σ has called the preceding star in all his observations about one and a half magnitudes smaller than the other. Adding 180° to DEMBOWSKI'S angle, and leaving the other observations as originally entered, we have:

1846·85	306°·2	0″·40	O Σ	1 night.
1852·64	295·1	0·33	O Σ	1 „
1859·65	290·6	0·46	O Σ	1 „
1869·82	319·9	—	De	3 nights.
1878·35	285·0	0·52	β	3 „
1880·81	293·9	0·34	β	1 night.

These are all the measures that have been made, and on the whole do not differ any more than would be expected in a star of this class where the components are relatively fixed.

No. 671. H. 1618.

R.A. 21ʰ 5ᵐ 40ˢ
Decl. + 43° 30′

1879·567	167°·4	21″·70	8·2...11·0	18 : 05	II.

H. gives 172°·0 : 15″± : 9–10...14. This was examined with this telescope in 1877, when H.'s companion was perceived to be itself double, the distance being about 3″. On the occasion of the above measure the seeing was too poor for BC. This is in the field with Σ 2773.

No. 672. Σ 2773.

R.A. 21ʰ 5ᵐ 50ˢ
Decl. + 43° 30′

A and B.

1879·567	116°·7	2″·97	8·2...8·4	18 : 15	II.

A and C.

1879·567	63°·5	22″·13	...13·0	18 : 20	II.

Σ did not see the faint star. There is probably no change in AB.

No. 673. ζ *Cygni.* (SMYTH.)

R.A. 21ʰ 7ᵐ 48ˢ
Decl. + 29° 44′

1879·400	67°·2	101″·39	...11·0	17 : 15	II.
1879·403	67·2	101·11	...11·0	17 : 10	II.
1879·40	67·2	101·25	...11·0		

No. 674. δ *Equulei.* *O Σ* 535.

R.A. 21ʰ 8ᵐ 38ˢ
Decl. + 9° 31′

A and B.

1880·592	34°·0	0′·32	4·5...4·7	21 : 10	V.
1880·597	28·9	0·35	—	20 : 15	V.
1880·602	29·0	0·33	—	20 : 20	V.
1880·610	27·8	0·41	—	19 : 15	V.
1880·613	26·0	0·35	3·5...3·7	19 : 45	V.

AB and C. (Σ 2777.)

1880·597	22°·9	38″·06	... 9·5	20 : 20	V.
1880·602	22·5	37·78	... 9·0	20 : 05	III.
1880·610	22·6	38·15	—	19 : 00	III.
1880·613	22·7	37·91	...10·0	20 : 00	III.
1880·675	22·1	38·00	--	—	

A and B form a rapid binary system. The only measures are by O Σ and myself. The second set was made at Madison with the 15½-inch. At all times the star was easy of measurement under proper conditions. The above measures are the first complete set ever made of this pair, the Pulkowa observations being usually single measures with long intervals between. If the present series could be continued annually for a few years the approximate period would soon be determined.

1880·60	29°·1	0″·35	β	5 nights.
1881·46	22·1	0·38	β	4 „
1882·63*	9·8	0·29	β	3 „
1883·55	307·6	0·21	β	3 „

The change in the old companion is the result of proper motion :

1836·65	37°·4	28″·07	Σ	3 nights.
1863·14	27·0	33·76	De	8 „
1880·60	22·7	37·98	β	5 „
1881·46	22·3	38·59	β	3 „

No. 675. Σ 2776.

R.A. 21h 8m 55s
Decl. − 10° 51′

A and B.

1880·698	51°·4	84″·19	...8·0	20 : 45	II.
1880·744	51·3	84·14	...8·0	21 : 10	II.
1880·772	51·8	84·40	—	21 : 00	II.
1880·74	51·5	84·24	...8·0		

B and C.

1880·698	338°·7	5″·73	9·0...9·5	20 : 50	II.
1880·744	338·4	5·77	9·0...9·5	21 : 05	II.
1880·772	342·1	5·86	—	21 : 05	II.
1880·74	339·7	5·79			

There is no change in AB, and perhaps none in BC, but STRUVE found 343°·9 : 5″·89 (1836·68).

* For details of measures of 1882–3, see Appendix.

No. 676. Σ 2778.

R.A. 21h 9m 28s
Decl. − 1° 44′

1880·698	270°·9	19″·85	8·2...9·0	21 : 00	II.
1880·744	271·4	19·97	8·0...9·3	21 : 20	II.

A slow change in angle and distance.

1828·24	267°·0	21″·19	Σ	4 nights.
1864·97	269·9	20·23	De	4 „
1880·72	271·2	19·91	ρ	2 „

No. 677. τ *Cygni*. A.G.C. 13.

R.A. 21h 10m 0s
Decl. + 37° 32′

1879·468	148°·8	0″·91	4·0... 9·0	18 : 20	IV.
1879·545	147·8	0·90	5·0...10·0	18 : 35	IV.
1879·50	148·3	0·90			

Binary in rapid motion.

No. 678. β 162.

R.A. 21h 12m 14s
Decl. + 35° 16′

A and B.

1880·769	241°·5	0″·98	8·0...8·0	20 : 45	IV.

A and C.

1880·769	138°·5	—	...13·0	20 : 50	II.

The only other measures are :

1875·11	240°·5	1″·05	De	4 nights.

No. 679. O Σ 435.

R.A. 21h 15m 19s
Decl. + 2° 23′

1880·592	207°·3	0″·57	8·0...8·0	21 : 30	V.

Not much change.

1848·13	203°·8	0″·60	O Σ	3 nights.
1866·03	196·2	—	De	3 „
1879·63	206·6	0·60	β	2 „

No. 680. *α Cephei.* (SMYTH.)

R.A. 21h 15m 42s
Decl. + 62° 5′

1879·351	23°·5	209″·48	...10·8	14 : 35	II.
1879·471	23·4	208·95	—	16 : 45	II.
1879·41	23·5	209·22			

SMYTH gives, 36°·0 : 150″·0 (1832·74). There are several faint stars near this distant companion, one about 20″ distant in 176°·2, which is a faint double star, with a distance of 2″ or 3″.

No. 681. *β* 448.

R.A. 21h 24m 35s
Decl. + 44° 24′

1879·545 I could not find this pair, or see any pair near here corresponding to the description of *β* 448. There may be some error in the place.

No. 682. *β Aquarii.* H. 936.

R.A. 21h 25m 14s
Decl. − 6° 6′

A and B.

1879·575	318°·0	34″·60	...10·8	—	
1880·742	318·8	33·93	...11·0	20 : 20	

A and C.

1880·742	184°·2	53″·98	...11·5	20 : 25	II.

Combining the previous measures we have:

1879·34	318°·9	34″·26	*β*	3 nights.
1879·22	184·9	54·51	*β*	2 „

No. 683. *β* 273.

R.A. 21h 28m 33s
Decl. + 10° 55′

1880·832	92°·4	″ —	8·0...11·3	20 : 50	II.
1880·865	91·4	5·45	8·0...11·8	22 : 00	II.

The only measures are:

1875·84	93°·1	5″·78	De	4 nights
1879·97	92·4	5·54	*β*	3 „

No. 684. 75 *Cygni.* A.C. 20.

R.A. 21h 35m 28s
Decl. + 42° 44′

A and B.

1880·567	329°·7	2″·25	...11·0	18 : 30	II.

A and C. (H. 1678.)

1880·567	254°·6	54″·86	...8·5	18 : 35	II.

No. 685. *β* 688.

R.A. 21h 37m 43s
Decl. + 40° 30′

1879·468	206°·6	0″·32	7·5...7·5	18 : 55	V.

A difficult pair near *77 Cygni*. From all the measures we have:

1878·36	208°·7	0″·35	*β*	5 nights.

No. 686. *ε Pegasi.* S. 798.

R.A. 21h 38m 17s
Decl. + 9° 20′

A and B.

1879·509	325°·1	81″·53	...11·5	18 : 00	
1879·573	325·3	81·18	...11·5	20 : 35	II.
1879·54	325·2	81·36	...11·5		

A and C.

1879·509	321°·4	140″·27	... 8·8	18 : 05	II.

DE. found, 321°·7 : 140″·41 (1874·77) 3 n.

No. 687. *μ Cygni.* Σ 2822.

R.A. 21h 38m 46s
Decl. + 28° 12′

A and B.

1880·485	118°·1	3″·78	—	—	II.
1880·553	118·7	3·90	—	19 : 40	II.
1880·52	118·4	3·84			

A and C.

1880·553	263°·9	35″·51	...11·5	19 : 45	II.

A and D.

1880·485	56°·6	208″·47	—	—	II.
1880·553	56·7	209·02	... 7·5	19 : 50	II.

My measures of the two distant stars give:

1878·91	263°·2	35·34	β	3 nights	AC
1879·82	56·5	208·67	β	3 „	AD

No. 687*a*. *μ Cephei*. β 690. (6 and 12·3.)

R.A. 21h 39m 50s
Decl. + 58° 14′

1879·534	258°·7	18″·93	6·0...13·0	19 : 40	II.

This is the well-known 'garnet star' of HERSCHEL, and, like many of the red stars, is variable. The mean of my measures is:

1878·87	259°·4	19″·16	β	3 nights.

No. 688. H. 947.

R.A. 21h 45m 57s
Decl. + 19° 16′

A and B.

1879·545	93°·1	20″·06	6·7...11·0	18 : 10	IV.
1880·744	92·8	19·91	6·8... 9·0	21 : 50	II.

A and C.

1879·545	325°·8	24′·10	...11·5	18 : 15	IV.
1880·744	325·7	23·75	...12·8	21 : 45	II.

With a previous observation the mean results are:

1879·56	92°·9	20·26	β	3 nights	AB
1879·56	324·8	24·08	β	3 „	AC

No. 689. Σ 2836.

R.A 21h 46m 21s
Decl. + 66° 14′

1879·562	153°·7	12″·87	7·8...11·0	17 : 30	

Measured with the small micrometer.

No. 690. *OΣ* (App.) 226.

R.A. 21h 50m 29s
Decl. + 67° 32′

1879·564	246°·2	76″·01	7·6...8·0	—	

With small micrometer. DE. 245°·7 : 75″·87 (1873·70) 1 n.

No. 691. 20 *Pegasi*. H. 289.

R.A. 21h 55m 14s
Decl. + 12° 33′

1879·509	324°·6	51″·09	...11·5	18 : 2	II.
1879·573	325·9	50·90	...11·3	20 : 55	II.

The only early measures, by SMYTH, are, 330°·0 : 35″·0 (1838·66). The mean of a previous measure and the above is:

1878·95	325°·5	51′·06	β	3 nights.

No. 692. *α Aquarii*. (SMYTH.)

R.A. 21h 59m 36s
Decl. − 0° 54′

1879·499	41°·5	115″·08	...12·0	19 : 20	II.
1879·507	41·5	114·20	...11·5		
1879·50	41·5	114·64	...11·7		

The only other measure is by SMYTH, 44°·0 : 116″·0 (1837·71).

No. 693. *OΣ* 462.

R.A. 22h 1m 48s
Decl. + 35° 31′

A and B.

1880·703	336°·2	1″·12	8·2...8·7	20 : 00	III.
1880·785	334·2	1·12	8·0...9·3	20 : 05	III.
1880·74	335·2	1·12	8·1...9·0		

A and C.

1880·703	30°·5	7″·19	...11·0	20 : 05	III.
1880·785	33·9	7·08	...12·0	20 : 10	III.

There seems to be no change in the close pair. The only measures of C are:

1850·00	33°·8	7″·53	0 Σ	3 nights.
1879·75	31·8	7·07	β	3 „

No. 694. π^1 *Pegasi.*

R.A. 22h 3m 54s
Decl. + 32° 35′

A and C.

1879·400	261°·3	73″·00	...10·9	—	II.
1880·832	262·0	72·72	...10·3	21 : 20	II.

A and D.

1879·400	89°·9	184″·74	...10·5	—	II.
1880·832	90·2	185·73	...10·8	21 : 25	II.
1880·12	90·0	185·24	...10·7		

There is a faint star nearer than those seen by previous observers, 284°·4 : 27″·40 (1877·78) 1 n. The three measures I have made of C give, 261°·7 : 72″·78 (1879·34) 3 n.

No. 695. Σ 2872.

R.A. 22h 4m 32s
Decl. + 58° 42′

B and C.

1880·592	326°·8	0″·59	7·8...8·0	19 : 00	V.

No. 696. Σ 2876.

R.A. 22h 6m 48s
Decl. + 37° 4′

1880·711	68°·5	11″·98	7·8...8·7	20 : 00	II.

Unchanged.

No. 697. Σ 2879.

R.A. 22h 7m 18s
Decl. + 62° 48′

1880·573	229°·3	0″·80	7·5...7·5	19 : 20	V.
1880·581	231·3	0·89	8·0...8·1	20 : 15	V.

There is very little change in this pair:

1836·35	226°·2	0″·80	Σ	3 nights.
1879·94	229·6	0·87	β	3 „

No. 698. Σ 2884. (8·1 and 9·0.)

R.A. 22h 8m 31s
Decl. + 63° 9′

1880·573	148°·6	2″·08	8·0...9·3	19 : 30	V.
1880·581	149·2	2·13	8·2...8·6	20 : 25	III.

Very little change, if any.

1833·55	151°·5	2″·09	Σ	3 nights.
1880·58	148·9	2·10	β	2 „

No. 699. Σ 2894.

R.A. 22h 13m 40s
Decl. + 37° 10′

1880·711	194°·0	15″·53	6·5...8·5	20 : 20	III.
1880·785	193·4	15·33	6·0...8·5	20 : 25	II.
1880·75	193·7	15·43	6·2...8·5		

Relatively fixed. There is a 12·5 m. star about 35″ distant in the direction of 250°.

No. 700. 0 Σ 469.

R.A. 22h 15m 11s
Decl. + 34° 31′

1879·567	282°·3	30″·78	7·3...8·0	19 : 30	II.
1880·785	282·9	30·78	—	20 : 40	II.

The distance seems to be slowly diminishing:

1846·79	280°·5	31″·80	0 Σ	3 nights.
1866·70	281·4	31·01	De	3 „
1880·18	282·6	30·78	β	2 „

No. 701. 2 *Lacertæ*. H. 1755.

R.A. 22h 16m 4s
Decl. + 45° 56′

1879·458	9°·5	48″·44	...11·0	19 : 30 III.
1879·493	9·9	47·96	...10·7	16 : 25 II.
1879·47	9·7	48·20	...10·9	

The only other measures are by Smyth.

No. 702. *O Σ* 470.

R.A. 22h 17m 26s
Decl. + 66° 22′

1879·562	357°·3	3″·73	8·0...10·7	17 : 10

With the small micrometer. Probably unchanged.

No. 703. Σ 2903.

R.A. 22h 18m 10s
Decl. + 66° 6′

1879·562	94°·8	4″·22	7·6...8·2	17 : 00

With the small micrometer. Unchanged.

No. 704. 34 *Pegasi*. β 290.

R.A. 22h 20m 30s
Decl. + 3° 47′

1880·594	220°·3	2″·64	6·0...12·0	22 : 20	III.

Combining this with the earlier measures, we have the following, which comprise all the observations:

1875·77	223°·3	2″·61	Hl	2 nights.
1878·49	218·9	2·62	β	5 „

No. 704*a*. β 291.

R.A. 22h 21m 39s
Decl. + 3° 55′

1879·575	166°·4	0″·47	8·0...8·3	—	V.
1880·594	164·6	0·53	8·5...8·8	22 : 00	V.

A very difficult pair, discovered with the 6-inch. It is within the triangle formed by 34, 35, and 37 *Pegasi*. Motion might be inferred from the measures, but the differences may come from the closeness of the components. The following are all the measures:

1875·82	157°·8	0″·32	De	4 nights.
1878·64	160·0	0·42	β	1 night.
1880·08	165·5	0·50	β	2 nights.

No. 704*b*. Σ 2906.

R.A. 22h 21m 26s
Decl. + 36° 50′

1879·567	3°·2	4″·03	7·5...10·3	19 : 10	II.

Only observed by Ma. since Σ. Probably unchanged.

No. 704*c*. 37 *Pegasi*. Σ 2912.

R.A. 22h 23m 54s
Decl. + 3° 49′

1879·575	113°·4	Direction of elongation uncertain. Distance not over 0″·25. First-class night.
1880·594		Single. V.

No. 705. 8 *Lacertæ*. Σ 2922.

R.A. 22h 30m 32s
Decl. + 39° 1′

A and B.

1879·400	185°·5	22″·14	—	—	II.
1880·775	186·3	22·46	6·0...6·5	20 : 35	II.

B and C.

1880·775	154°·9	27″·79	...10·5	20 : 40	II.
1880·785	155°·0	28·05	5·8... 9·0	21 : 00	III.

B and D.

1879·400	131°·4	66″·64	—	—	
1880·775	131°·0	66·45	... 9·3	21 : 50	II.

A and D.

1879·400	144°·4	81″·49	—	—	II.
1880·785	144·3	81·53	5·0... 8·5	20 : 50	III.
1880·09	144·4	81·51			

All relatively fixed.

1831·61	185°·7	22″·47	Σ	3 nights	AB
1880·09	185·9	22·30	β	2 „	
1830·96	155·2	28·15	Σ	2 „	BC
1880·77	155·0	27·92	β	2 „	
1830·96	131·6	66·49	Σ	2 „	BD
1880·09	131·2	66·54	β	2 „	

No. 706. Σ 2926.

R.A. 22h 32m 5s
Decl. + 38° 17′

1879·567	335°·8	21″·10	8·5...8·5	—	II.

Fixed.

No. 707. β 277.

R.A. 22h 34m 12s
Decl. + 40° 45′

1879·458	199°·3	0″·59	8·0...8·3	19 : 45	IV.

A difficult pair. The only other measures are :

1875·35	199°·5	0″·50	De	4 nights.

No. 708. ζ *Pegasi.*

R.A. 22h 35m 38s
Decl. + 10° 12′

A and B.

1879·545	137°·8	64″·33	...11·0	20 : 00	III.

A and C. (Smyth.)

1879·509	5°·2	177″·0	...11·0	Single distance	II.

No star in the place given by Smyth.

No. 709. Σ 2942.

R.A. 22h 38m 40s
Decl. + 38° 50′

A and B.

1879·468	281°·0	2″·72	6·8...8·5	17 : 20	III.

A and C. (β 450.)

1879·468	233°·4	11″·08	...12·5	17 : 25	III.

There is no material change in AB. My three measures of the new companion give 232°·7 : 10″·98 (1878·58) 3 n.

No. 710. 13 *Lacertæ.* Ο Σ 479.

R.A. 22h 38m 44s
Decl. + 41° 11′

1879·400	129°·5	14″·11	...10·5	—	II.
1880·785	130·4	14·11	6·0...11·5	21 : 15	II.
1880·09	130·0	14·11			

Probably unchanged.

No. 711. ξ *Pegasi.* H. 301. (4 and 12.)

R.A. 22h 40m 42s
Decl. + 11° 33′

A and B.

1879·545	113°·0	11″·99	...11·8	20 : 45	III.
1880·763	113·8	11·88	...13·0	21 : 00	II.

A and C. (Smyth.)

1879·509	21°·8	127″·03	...11·5	18 : 45	II.
1879·545	21·7	127·63	...11·0	20 : 10	II.

The only other measures of C are by Smyth, 32°·5 : 110″·0 (1834·79). The following are all the measures of H.'s companion :

1866·80	117°·7	12″·17	De	2 nights.
1879·38	112·6	11·93	β	4 „

No. 712. β 452.

R.A. 22h 51m 37s
Decl. + 42° 22′

1880·703	256°·8	6″·78	6·7...11·2	20 : 20	II.
1880·709	256·4	6·70	7·2...11·0	20 : 45	II.
1880·71	256·6	6·74	7·0...11·1		

The only other measure is, DE. 255°·3 : 6″·29 (1877·70) 1 n.

No. 713. *O Σ* 484.

R.A. 22h 52m 28s
Decl. + 72° 12′

A and B.

1879·490	94°·6	0″·32	7·0...7·5	—	V.
1880·573	90·7	0·33	7·8...8·2	18 : 50	V.

A very difficult and close pair, and beyond the reach of many instruments. The following are all the measures:

1851·00	108°·5	0″·41	O Σ	4 nights.
1880·55	91·9	0·33	β	3 „

Measures of the more distant stars, AC (=Σ 2966 *rej.*), AD (=S. 820), DE (=Σ 2965), will be found in the Washburn Observatory measures.

No. 714. *β Pegasi.* H. 1842.

R.A. 22h 57m 56s
Decl. + 27° 26′

1879·490	208°·0	97″·91	...11·5	20 : 30	II.
1879·526	208·5	98·86	...11·0	—	II.
1879·51	208·2	98·38	...11·2		

H. gives the angle, 204°·1. The only other measures are in the Bedford Catalogue.

No. 715. *β* 78.

R.A. 23h 2m 6s
Decl. + 30° 49′

A and B.

1879·567	55°·0	34″·44	7·2...11·0	19 : 50	II.

A and C.

1879·567	61°·9	48″·07	...11·5	19 : 55	II.

No other measures.

No. 716. *π Cephei* *O Σ* 489.

R.A. 23h 4m 5s
Decl. + 74° 44′

1879·492	21°·8	0″·98	5·0...8·0	16 : 40	IV.

No. 717. *ψ Aquarii.* Σ 12. App. II.

R.A. 23h 9m 35s
Decl. − 9° 44′

A and B.

1880·865	313°·6	49″·86	5·0...8·5	22 : 30	II.
1880·867	312·1	49·53	4·5...8·5	22 : 25	II.
1880·870	312·4	49·86	—	21 : 30	II.
1880·911	312·2	49·39	—	23 : 10	II.

A and D.

1880·911	274·3	64·96	...13·5	23 : 20	II.

There is no change in the old companion:

1836·66	312°·2	49″·63	Σ	4 nights.
1877·84	312·6	49·89	Ja	3 „
1880·88	312·6	49·66	β	4 „

No. 718. 8 *Andromedæ.* *β* 717. (5 and 13.)

R.A. 23h 12m 11s
Decl. + 48° 22′

1880·813	161°·4	7″·37	5·0...14·0	20 : 50	II.

From all the measures we have:

1878·88	161°·4	7″·55	β	4 nights.

No. 719. 64 *Pegasi.* *β* 718.

R.A. 23h 16m 3s
Decl. + 31° 9′

1878·854	92°·5	0″·48	6·0...9·5	—	V.

All the measures of this fine pair are included in the following:

1878·74	88°·3	0″·47	β	4 nights	5·0...8·7
1878·74	85·7	0·53	De	1 night	5·0...7·0

No. 720. 4 *Cassiopeæ*. ℍ VI. 24.

R.A. 23h 19m 30s
Decl. + 61° 37′

A and B.

1879·471	226°·2	98″·13	6·0...8·5	16 : 05	II.

A and C.

1879·471	258°·3	214″·35	—	16 : 10	II.

C and D.

1879·471	35°·3	10″·30	9·5...10·5	16 : 20	II.

The only prior measures are by Smyth.

No. 721. P. XXIII. 101. *O Σ* 496.

R.A. 23h 24m 29s
Decl. + 57° 53′

A and B. (= O Σ 496.)

1880·627	342°·6	1″·26	6·3...10·5	19 : 20	V.
1880·813	343·1	1·50	...11·0	21 : 15	IV.

C and D. (= Da. 2.)

1880·627	225°·3	1″·36	8·0...10·0	19 : 30	V.
1880·675	224·4	1·74	8·5...10·0	21 : 05	II.
1880·813	225·7	1·42	8·0... 9·0	21 : 20	IV.

A and C. (= Sh. 355.)

1880·636	269°·0	75″·67	6·0... 7·8	19 : 15	III.
1880·649	269·1	75·47	6·5... 7·5	20 : 40	II.
1880·675	268·7	75·66	—	—	

A and *a*. (= H. 1888.)

1880·636	114°·5	43″·62	...10·5	19 : 20	III.
1880·649	114·5	43·07	...10·5	20 : 45	II.
1880·675	115·0	43·89	—	—	

A and *b*.

1880·636	338°·7	67″·15	...10·5	19 : 25	III.
1880·649	338·1	66·37	...10·5	20 : 50	II.
1880·675	338·6	67·22	—	20 : 50	II

C and *d*. (= H. 1886.)

1880·636	336°·8	27″·37	...11·5	19 : 30	III.
1880·649	337·3	26·55	...11·5	21 : 00	II.
1880·675	337·2	26·68	...11·8	21 : 05	II.

b and *c*. (H. 1887.)

1880·636	74°·3	11″·06	...10·5	19 : 25	III.
1880·649	74·6	10·65	...10·5	21 : 00	II.
1880·675	74·3	10·83	10·5...10·5	20 : 55	II.

A fine quadruple system, with several faint companions in the field. O Σ has but a single measure of AB, and the only measures are those given above and two later measures made at Madison. The faint stars have been measured by De. only. There is very little if any change in CD.

1851·76	336°·8	1″·51	O Σ	1 night	A and B
1881·16	344·6	1·37	β	4 nights	
1849·64	224·2	1·38	O Σ	5 „	C and D
1867·94	223·8	1·39	De	4 „	
1881·16	223·1	1·44	β	6 „	
1849·64	269·2	76·10	O Σ	5 „	A and C
1868·68	269·3	75·63	De	3 „	
1881·23	269·0	75·78	β	5 „	
1869·76	113·9	43·36	De	2 „	A and *a*
1880·65	114·7	43·53	β	3 „	
1869·76	338·5	67·11	De	2 „	A and *b*
1880·65	338·5	66·91	β	3 „	
1841·81	341·8	25″·±	Da	1 night	C and *d*
1880·65	337·1	26·87	β	3 nights	
1869·76	73 5	10·29	De	2 „	*b* and *c*
1880·64	74·4	10·85	β	2 „	

No. 722. β 774.

R.A. 23h 25m 18s
Decl. + 63° 40′

1880·573	7°·7	0″·44	8·5...9·0	17 : 50	V
1880·581	4·6	0·54	8·3...8·5	19 : 45	V.
1880·592	7·8	0·55	8·5...9·0	18 : 45	V.
1880·58	6·7	0·51	8·4...8·8		

A very difficult pair, even with this aperture, discovered at Mount Hamilton with the 6-inch. There are no other measures.

No. 723. (Winnecke.)

R.A. 23h 26m 35s
Decl. + 30° 47′

1880·573	169°·7	1″·48	8·0...10·5	20 : 40	V.

The only other measures are:

1863·85	168°·5	1″·51	Wn	2 nights.

No. 724. 72 *Pegasi.* β 720.

R.A. 23h 28m 0s
Decl. + 30° 40′

1878·854	128°·4	0″·44	6·0...6·0	—	V.
1880·573	311·4	0·45	6·0...6·2	20 : 20	V.
1880·592	313·1	0·34	6·0...6·1	22 : 05	V.

A fine pair, but close, and rather difficult. The following are all the measures:

1878·74	127°·7	0″·40	β	7 nights	6·0...6·0
1878·74	128·7	0·38	De	1 night	5·5...6·0
1880·01	311·0	0·41	β	3 nights	6·0...6·1

No. 725. De. 27.

R.A. 23h 32m 53s
Decl. + 43° 46′

1878·780	70°·5	1″·96	9·0...11·5	—	

Discovered by De. The only other measures are:

1872·67	73°·8	2″·03	De	3 nights.

No. 726. κ *Andromedæ.* H. 1898.

R.A. 23h 34m 30s
Decl. + 43° 40′

A and B.

1878·780	188°·9	46″·34	4·0...11·0	—	II.
1879·458	189·1	47·16	...11·0	20 : 00	II.
1879·490	188·1	46·43	...11·0	20 : 10	II.
1879·24	188·7	46·64	...11·0		

A and C.

1879·458	294°·6	103″·17	...11·0	20 : 05	III.

No. 727. ι *Piscium.*

R.A. 23h 33m 48s
Decl. + 4° 59′

A and B.

1879·545	288°·2	53″·7	...13–14	20 : 45	III.
1879·573	287·8	54·3	...13	21 : 20	II.

A and C. (Smyth.)

1879·545	33°·5	280″·7	—	20 : 40	III.
1879·573	33·8	280·3	—	21 : 15	II.

All single distances. B is very faint, and observed for the first time.

No. 728. Σ 3034. (7·8 and 9·1.)

R.A. 23h 38m 36s
Decl. + 45° 43′

1879·458	98°·7	5″·58	7·5...9·0	20 : 35	II.
1880·739	103·4	5·68	8·0...9·0	19 : 55	II.
1880·775	104·1	5·46	7·8...9·3	21 : 50	II.

Relatively fixed.

1831·85	103°·8	5″·35	Σ	3 nights.
1880·32	102·1	5·57	β	2 „

No. 729. *O* Σ 505.

R.A. 23h 39m 20s
Decl. + 19° 45′

1880·593	62°·2	2″·01	7·6...10·5	0 : 10	II.

Unchanged.

No. 730. β 390.

R.A. 23h 41m 34s
Decl. + 48° 38′

1880·739	233°·9	18″·02	8·3...11·8	20 : 10	II.

The only other measures are:

1879·59	233°·9	18″·35	Cin	3 nights.

No. 731. B.A.C. 8277. *O* Σ 507.

R.A. 23h 42m 50s
Decl. + 64° 13′

A and B.

1880·627	251°·8	0″·60	8·0...8·5	19 : 40	II.
1880·813	255·9	0·57	7·0...8·0	21 : 30	IV.
1880·72	253·8	0·58	7·5...8·2		

AB and C.

1880·627	353°·5	48″·89	...8·5	19 : 45	II.
1880·813	353·4	48·86	...8·7	21 : 35	III.
1880·72	353·4	48·87	...8·6		

The distant star has not changed, but the angle of the close pair seems to be increasing.

No. 732. Σ 3047.

R.A. 23h 51m 49s
Decl. + 56° 43′

A and B.

1880·739	70°·3	0″·89	—	20 : 20	II.

A and C. (β 280.)

1880·739	185°·9	8″·08	...12·5	20 : 25	II.

A slow advance in the angle of AB.

No. 733. OΣ 513.

R.A. 23h 52m 13s
Decl. + 34° 21′

1880·731	23°·9	3″·43	7·8...9·0	21 : 05	II.
1880·775	22·7	3·44	7·5...9·5	21 : 15	II.
1880·75	23·6	3·44	7·6...9·2		

The components are relatively fixed.

No. 734. 27 *Piscium*. β 730. (6 and 11.)

R.A. 23h 52m 32s
Decl. − 4° 13′

1878·865	262°·0	1″·49	5·0...11·5	—	IV.
1880·829	266·8	1·71	6·0...11·0	23 : 35	III.

The mean of all my measures is:

1878·97	265°·2	1″·49	β	5 nights.

No. 735. β 482.

R.A. 23h 55m 44s
Decl. + 62° 39′

A and B.

1880·739	341°·6	4″·28	9·5... 9·8	21 : 00	II.

A and C.

1880·739	125°·9	9″·46	...11·8	21 : 05	II.

The only other measures are:

1877·25	342°·8	4″·07	De	2 nights.

No. 736. 85 *Pegasi*. β 733.

R.A. 23h 55m 52s
Decl. + 26° 27′

A and B.

1878·854	282°·3	0″·98	6·0...11·5	—	V.
1879·458	287·2	0·73	6·0...12·0	21 : 15	III.
1879·540	278·3	0·72	6·0...11·0	23 : 25	V.
1879·545	289·4	0·61	—	21 : 45	V.
1879·898	285·9	0·72	...11·0	—	IV.
1880·573	300·1	0·61	—	21 : 10	V.
1880·589	298·0	0·68	...10·5	21 : 20	V.
1880·592	296·6	0·62	—	21 : 20	V.
1880·594	998·0	0·68	—	22 : 45	V.
1880·613	298·8	0·67	—	21 : 50	V.

A and C.

1878·854	31°·7	14″·73	... 9·0	—	V.
1878·961	31·8	14·75	... 9·0	0 : 40	II.
1878·980	33·0	14·79	... 9·0	23 : 30	II.
1879·030	31·1	14·79	—	1 : 00	III.
1879·458	29·6	15·20	... 9·0	21 : 20	III.
1879·468	29·1	15·02	—	20 : 00	III.
1879·545	28·3	15·04	—	21 : 50	III.
1879·898	28·7	15·40	... 9·0	—	IV.
1880·551	25·0	15·31	—	20 : 40	II.
1880·559	25·1	15·50	—	20 : 25	V.
1880·562	25·2	15·32	—	19 : 50	III.
1880·573	25·0	15·52	—	20 : 55	V.
1880·581	24·7	15·37	—	22 : 00	V.
1880·589	24·8	15·47	—	21 : 30	V.

A and D.

1878·961	277°·1	61″·73	...13·0	0 : 50	II.
1880·559	278·0	64·25	...12·5	20 : 30	V.

Undoubtedly one of the most interesting binary systems. The principal star has a large proper motion, and, according to BRUNNOW, a parallax of 0″·054. The discovery of the close companion is due to the distinguished French astronomer, FLAMMARION, at whose request I commenced a series of measures of the more distant star. The new star is a very difficult object even with this instrument, except under the very best conditions. As stated in my first series of observations, it was evident that a very short interval would be sufficient to determine from inspection, without any measures at all, whether the new star had the same proper motion as 85, and therefore whether it was a physical system. In six months the movement of the larger star in space would so much increase the distance of the companion if the latter was stationary, that the change would be obvious without the use of the micrometer. The measures since 1878 show conclusively that not only does the small star have the same proper motion, but also an orbital motion of about 12° per annum. My last measure, given below, was made at the Washburn Observatory in 1881. The star seemed to be much more difficult than in prior years, after making the proper allowance for the smaller aperture of the Madison refractor. I have not examined it this year (1882). The following are the results of all my measures:

1878·73	274°·0	0″·67	β	3 nights.
1879·46	284·6	0·75	β	5 „
1880·59	298·3	0·65	β	5 „
1881·54	311·5	0·58	β	1 night.

The position of the 9 m. companion is rapidly changing from the proper motion of A. The following are the principal measures:

1855·00	105°·0	30″·0	Arg	
1870·00	77·0	16·00	Bru	
1877·94	49·8	14·0	Flm	1 night.
1878·54	33·6	14·40	β	4 nights.
1879·27	30·4	14·96	β	8 „
1880·57	25·0	15·41	β	6 „
1881·54	20·8	16·29	β	4 „
1882·77	17·1	17·34	β	3 „

The fourth star, D, is faint, and, of course, too distant to have any special interest.*

No. 737. *O Σ* 547.

R.A. 23h 59m 12s
Decl. + 45° 9′

1880·711	115°·3	4″·65	8·2...8·3	21 : 15	III.
1880·722	114·7	4·38	8·4...8·5	20 : 00	II.
1880·728	113·9	4·54	8·5...8·5	20 : 10	II.
1880·775	115·7	4·30	8·0...8·0	21 : 25	II.

A very interesting pair, and certainly binary, as the two components have the same proper motion of about 1″ annually. The following are all the measures:

1875·80	290°·8	4″·13	De	2 nights	8·0...8·2
1876·07	110·9	4·49	O Σ	3 „	8·3...8·3
1879·81	293·9	4·35	Hl	2 „	—
	114·9	4·47	β	4 „	8·3...8·4

No. 738. Σ 3062.

R.A. 23h 59m 57s
Decl. + 57° 46′

1880·581	303°·4	1″·57	6·8...7·3	20 : 50	IV.
1880·589	304·4	1·43	7·5...7·9	19 : 15	IV.
1880·592	304·0	1·40	—	19 : 50	V.
1880·610	306·2	1·62	—	19 : 50	V.
1880·613	304·9	1·50	—	22 : 10	V.
1880·627	304·3	1·48	—	22 : 40	V.
1880·60	304·5	1·50			

* See Appendix.

Measures of Double Stars made at Mount Hamilton, California, November 1 to 13, 1881, with the 12-inch Refractor of the Lick Observatory.

(The measures of *Sirius*, 40 *Eridani*, Σ 547, and β 4 are incorporated with the Chicago Observations.)

No. 739. Σ 49. (7·6 and 9·0.)

R.A. 0h 34m 42s
Decl. − 7° 53′

1881·832	320°·2	5″·92	7·5...9·5	21 : 50	I.
1881·835	320·6	6·42	7·7 ..8·8	23 : 40	II.
1881·838	323·1	5·97	7·7...8·8	22 : 15	III.

There appears to be some change:

1830·92	321°·5	4″·49	Σ	3 nights.
1877·30	320·5	5·92	Cin	3 „
1881·83	321·3	6·10	β	3 „

No. 740. 37 *Ceti*. Σ 3. App. I.

R.A. 1h 8m 21s
Decl. − 8° 34′

1881·832	330°·8	49″·93	7·0...8·0	22 : 15	I.
1881·835	331·1	49·65	—	0 : 15	III.
1881·838	331·1	50·12	5·0...7·0	22 : 30	III.

Relatively fixed, but common proper motion.

1836·0	331°·4	50″·12	Σ	4 nights.
1878·52	331·6	50·12	Je	3 „
1881·83	331·0	49·90	β	3 „

No. 741. 42 *Ceti*. Σ 113.

R.A. 1h 13m 41s
Decl. − 1° 8′

1881·832	351°·5	1″·60	6·5...7·0	22 : 40	III.
1881·835	348·9	1·60	6·0...6·2	23 : 50	III.
1881·845	—	1·55	—	0 : 50	III.
1881·83	350·2	1·58	6·2...6·6		

No. 742. Σ 122.

R.A. 1h 20m 41s
Decl. + 2° 55′

1881·832	327°·7	6″·20	8·0...9·0	22 : 55	I.
1881·838	329·2	6·29	7·5...9·0	0 : 10	II.
1881·843	327·7	6·21	7·7...8·5	1 : 40	III.
1881·84	328·2	6·23	7·7...8·8		

Recent observers make the angle a little less than STRUVE'S measures.

No. 743. S. 398. (7·0 and 8·0.)

R.A. 1h 22m 5s
Decl. + 7° 20′

1881·832	98°·6	69″·30	7·0...8·0	23 : 05	I.
1881·838	99·1	69·47	7·0...8·0	0 : 20	II.
1881·843	98·6	69·27	7·3...8·3	1 : 50	III.
1881·845	—	69·26	7·0...8·0	0 : 40	II.

Evidently fixed. The following are all the measures:

1825·00	98°·3	69″·75	S	2 nights.
1874·45	99·1	69·23	De	3 „
1881·84	98·8	69·32	β	3 „

No. 744. H. 3437.

R.A. 1h 22m 16s
Decl. − 17° 53′

1881·832	248°·8	11″·49	8·0...9·0	22 : 05	I.
1881·835	248·6	12·07	7·5...8·7	0 : 05	III.
1881·838	247·4	12·17	8·0...8·7	22 : 45	III.
1881·83	248·3	11·91	7·9...8·8		

Probably fixed.

No. 745. H. 3447.

R.A. 1h 30m 35s
Decl. − 30° 31′

1881·835	86°·6	2″·13	6·5...7·0	1 : 00	IV.
1881·838	87·5	2·24	7·0...8·0	1 : 05	II.
1881·843	87·7	2·18	6·7...7·5	2 : 05	II.
1881·845	—	2·22	6·5...7·3	1 : 00	III.

Change in angle and distance seems probable:

1837·22	75°·4	3″·35	H	1 night.
1846·8	83·4	2·95	J	
1877·80	90·1	2·20	Cin	3 nights.
1881·84	87·3	2·19	β	4 „

No. 746. Σ 150.

R.A. 1h 37m 22s
Decl. − 7° 41′

1881·832	195°·8	36″·16	8·0...8·0	22 : 25	I.
1881·835	195·3	36·26	8·0...8·0	0 : 25	III.
1881·838	196·0	36·30	7·5...7·7	23 : 00	III.

The components appear to be fixed:

1831·88	195°·5	36″·19	Σ	3 nights.
1881·33	195·7	36·24	β	3 „

No. 747. 84 *Ceti.* Σ 295.

R.A. 2h 35m 4s
Decl. − 1° 12′

1881·832	324°·0	4″·70	6·5...9·0	23 : 50	I.
1881·838	325·0	4·70	...9·0	0 : 35	II.
1881·83	324·5	4·70			

No. 748. H. 3770.

R.A. 5h 28m 33s
Decl. − 24° 35′

1881·843	17°·7	3″·94	8·0...12·0	4 : 00	II.
1881·865	18·2	4·26	—	3 : 50	II.
1881·85	18·0	4·10			

No other measures, except angle of 10°·0 by H.

No. 749. H. 5356.

R.A. 22h 33m 5s
Decl. − 28° 57′

A and B.

1881·829	161°·7	86″·54	7·5...	21 : 30	I.
1881·832	159·5	86·46	7·5...	—	II.
1881·838	159·4	86·85	7·0...	21 : 45	III.
1881·83	160·2	86·62	7·2		

B and C.

1881·829	61°·1	2″·96	8·0...8·5	21 : 35	I.
1881·832	58·2	2·89	8·0...8·5	—	II.
1881·838	59·8	2·96	8·0...8·5	21 : 50	III.
1881·83	59·7	2·94	8·0...8·5		

The distance of BC seems to be diminishing.

No. 750. δ *Piscis Australis.* β 772.

R.A. 22h 49m 18s
Decl. − 33° 11′

1881·835	235°·9	5″·14	5·0...11·0	22 : 50	II.
1881·838	233·3	4·92	...11·0	22 : 05	II.
1881·843	238·0	5·11	5·0...11·0	22 : 45	II.
1881·845	—	4·23	...11·5	22 : 40	II.
1881·859	236·2	5·15	...11·0	23 : 05	III.
1881·84	235·8	4·91	...11·0		

This fine pair was discovered at Mount Hamilton with the 6-inch in 1879.

No. 751. θ *Gruis.*

R.A. 23h 0m 40s
Decl. − 44° 10′

1881·843	21°·4	2″·72	5·0...9·0	22 : 40	II.
1881·859	22·7	2·59	—	23 : 10	II.
1881·85	22·0	2·65			

APPENDIX.

Map Showing a Distribution of Double Stars.

The diagram given at the commencement of this Paper was prepared in the first instance for my own information concerning the distribution in space of the new double stars contained in this and the preceding catalogues. It then seemed that a reproduction of it might properly find a place at the close of the series. These double stars are as uniformly scattered over the surface of the sky as could be expected when due allowance is made for the unequal distribution of stars generally, and the difference in observing weather at different seasons of the year. The Milky Way of course furnishes a greater number of new double stars than the same area elsewhere; and that part of the heavens on the Meridian in the fall and summer months was more carefully examined, and with correspondingly better results.

No systematic search has been made for the discovery of new pairs. At this time, when comparatively so little has been done in the detection of really difficult objects, it is hardly worth while taking the necessary time to follow any special plan in looking for new pairs. No appreciable amount of time can be lost by the repeated examination of stars when the telescope is directed at random. A hundred years hence it may be desirable to make a careful systematic study of all the stars, not known to be double, down to the eleventh or twelfth magnitude, with the great refractors of that time, and especially if some location shall be found where a steady air and good definition can be had most of the time, at certain seasons of the year at least. Under such circumstances a thorough examination by an experienced observer of stars not catalogued as double would lead to valuable results, and would practically exhaust the field of discovery so far as the moderate or

smaller apertures used in observatories now established are concerned. The Southern Hemisphere, however, is an almost untried field, particularly that portion within 40° of the South Pole. Very few close pairs have been discovered, and in the region mentioned there is probably not one double star known that would be called difficult with the telescope of this Observatory. Assuming a uniform distribution of double stars in the Northern and Southern Hemispheres, several hundred fairly close pairs could be picked up with a small aperture of first-class definition without going below the eighth magnitude. A large number of close and unequal pairs will be found in the naked-eye stars.

The whole number of stars represented in the accompanying map is 1,000, of the following orders of brightness :—

Magnitudes.	No. of Stars.	Magnitudes.	No. of Stars.
0 to 1·0	2	5·1 to 6·0	94
1·1 „ 2·0	8	6·1 „ 7·0	173
2·1 „ 3·0	11	7·1 „ 8·0	303
3·1 „ 4·0	11	8·1 „ 9·0	300
4·1 „ 5·0	29	9·1 „ +	69
Total	...	...	1000

Limiting Distance of New Pairs.

My catalogues, particularly the earlier ones, contain a few stars which, from the distance of the components, it would have been better to reject. It may sometimes be desirable to record faint companions to bright stars and previously known pairs when they are beyond the ordinary limits of distance, but it is rare that the maximum distance of the Pulkowa Catalogue, 16″, should be exceeded, and in stars from 8 or 8·5 magnitude down, the companion should generally be within 5″ at the most. Pairs of this distance will rarely prove of much interest. All the rapid and interesting binaries are much closer.

Omitting some of the wider pairs, and also the close pairs which have

not been measured, there are left 743 double stars out of 1,000 which are represented by the following mean distances :—

Magnitude.	No. of Stars.	Mean Distances.
3·1 to 4·0	6	1″·88
4·1 „ 5·0	16	1·89
5·1 „ 6·0	61	1·80
6·1 „ 7·0	119	1·92
7·1 „ 8·0	240	1·36
8·1 „ 9·0	247	1·57
9·1 „ +	54	1·63
Mean distance of 743 stars =		1·58

In the early history of double-star astronomy, when for this work instruments were inferior as well as smaller, there might have been some excuse for including in a catalogue wide pairs, and those where both components were faint; but at this time there is no justification for ever calling two tenth-magnitude stars which happen to be 5″ or 10″ apart a double star in the proper sense of the term. At any time since the publication of the work of STRUVE the time spent in observing such objects would be little less than lost, and this will necessarily be the case for all time to come. Of course it is very easy to make with a telescope very moderate in size and indifferent in definition, an imposing catalogue of so-called discoveries, so far as numbers go, if these faint and wide couples are included ; but the value of such a list now and in the future will depend solely upon the number of first-class pairs it contains. The Pulkowa Catalogue, as given in Vol. IX. of the publications of that Observatory, will serve as a model for this class of work so far as the element of distance is concerned. A close pair—that is, where the distance does not exceed 1″—should be recorded, however faint the components may be, and of course the magnitude of the companion to any star should have no weight in retaining or measuring it as a double star.

An examination of the various double-star catalogues of original entry with reference to the proportion of close pairs is instructive as illustrating the

relative number of systems of this kind in each, as well as showing the greater perfection of modern telescopes for this kind of work. Those of the STRUVES are so well known that further comment is unnecessary.

The seven catalogues of Sir JOHN HERSCHEL contain nine stars where the estimated distance is 1″ or less. Of this number I have examined and measured seven, the distances being 2″·5; 1″·81 ("violent suspicion," H.); 1″·02 ("almost certain," H.); 2″·27; 3″·26; 1″·2 ("not verified," H.); and 1″·80. The remaining two could not be found, one being noted as doubtful by HERSCHEL. So that at most we have only two pairs of Class I. HERSCHEL gives 68 stars of Class II., estimated 1½″ to 2″, all of which, with perhaps three or four exceptions, are below the ordinary limits of magnitude, most of them being from 10 to 12 magnitude. In all, about 24 of these stars have recently been observed, mostly at Cincinnati and Chicago, of which 16 exceed 2″ in distance, and four were not found as described, four pairs only coming within the limits of Class II. It is practically certain that of the remaining 44 stars there would not be more than a dozen that would come within the required distance. I have assumed the number, however, to be 20.

The following Table gives all the principal original double-star catalogues published, and the number of pairs in each of Class I. (distance from 0″ to 1″) and Class II. (distance from 1″ to 2″). In the last column is given the ratio of stars of these classes to each thousand double stars catalogued by the discoverer.

	Class I.	Class II.	Total.	Ratio.
BURNHAM, Catalogue of 1,000 stars ...	266	254	520	520 : 1000
O. STRUVE „ „ 547 „ ...	154	63	217	400 : 1000
STRUVE „ „ 2,640 „ ...	91	314	405	150 : 1000
HERSCHEL I. „ „ 812 „ ...	12	24	36	45 : 1000
HERSHEL II. „ „ 3,429 „ ...	2	20	22	7 : 1000
ALVAN G. CLARK	14	1	15	
All other observers	40	75	129	
			1344	

From this investigation we find the pairs having a distance not exceeding 2″ are less than 1,400; and it is safe to say that the total number of stars now known which can be properly called double is but little if any greater than 3,000, and that at least three-fourths of the remainder are not worth observing for any reason.

Later Measures.

The observations given in the foregoing pages terminate in 1880, but while the copy was passing through the press a few measures of specially interesting stars have been made by me at the Dearborn Observatory. Most of the mean results were incorporated in the proof. The individual measures are as follows:—

40 *Eridani.* Σ 518. (Page 236.)

B and C.

1882·988	119°·7	2″·99		
1883·000	118·7	3·15		
1883·00	119·2	3·07		

S. 503. (Page 248.)

A and B.

1883·102	82°·0	3″·01	5 : 05	III.
1883·104	81·3	2·85	5 : 10	III.
1883·112	84·5	2·84	3 : 55	III.
1883·11	82·6	2·90·		

A and C.

1883·096	158°·8	24″·71	4 : 45	III.
1883·102	159·2	24·62	5 : 00	III.
1883·104	158·7	24·48	5 : 05	III.
1883·112	158·7	24·63	4 : 00	III.
1883·10	158·8	24·61		

A and D.

1883·102	333°·9	234″·33	4 : 50	II.
1883·104	334·6	233·98	5 : 00	I.
1883·112	334·5	233·95	4 : 10	I.
1883·11	334·3	234·09		

Sirius. (Page 253.)

1882·988	41°·6	9″·16	5 : 20	III.
1883·000	40·3	9·27	4 : 40	III.
1883·074	41·1	8·99	6 : 30	III.
1883·107	39·9	9·02	—	—
1883·115	39·8	9·17	7 : 10	III.
1883·134	40·1	8·90	6 : 00	III.
1883·137	38·1	9·17	5 : 30	III.
1883·151	41·0	8·92	6 : 00	III.
1883·153	40·6	8·91	7 : 40	III.
1883·159	39·6	8·86	6 : 30	III.
1883·10	40·1	9·05		

A and D.

1883·151	155°·9	98″·46	6 : 10	III.

9 *Argus.* β 101. (Page 262.)

1883·115	336°·2	0″·3±	7 : 45	V.

This single observation confirms the angular motion shown by the prior measures. The seeing was not good enough to measure the distance, which was evidently less than when observed in 1878. This pair will probably prove to be a rapid binary.

μ Herculis. A.C. 7. (Page 294.)

B and C.

1883·515	261°·8	0″·72	—	III.
1883·523	260·9	0·67	—	III.
1883·542	263·5	0·83	—	III.
1883·53	262·1	0·74		

The result of these measures is not given on page 294.

β Delphini. β 151. (Page 310.)

A and B.

1882·507	174°·6	—	—	V.
1882·616	161·0	0·33	—	V.
1882·531	163·7	0·25	—	V.
1882·753	170·6	0·19	—	V.
1883·542	181·1	0·25	—	V.
1883·559	183·5	0·20	—	V.
1883·562	182·9	0·24	—	V.
1882·60	167·5	0·26	3 nights.	
1883·55	182·5	0·23	3 „	

The single measures of the HERSCHEL and STRUVE companions are given on page 310. There has been but little change in the distance of the close pair in the last three years. The angular motion since its discovery in 1873 is not less than 180°, and it may prove to have, with the single exception of δ *Equulei*, the shortest period known.

δ *Equulei.* *OΣ* 535. (Page 313.)

A and B.

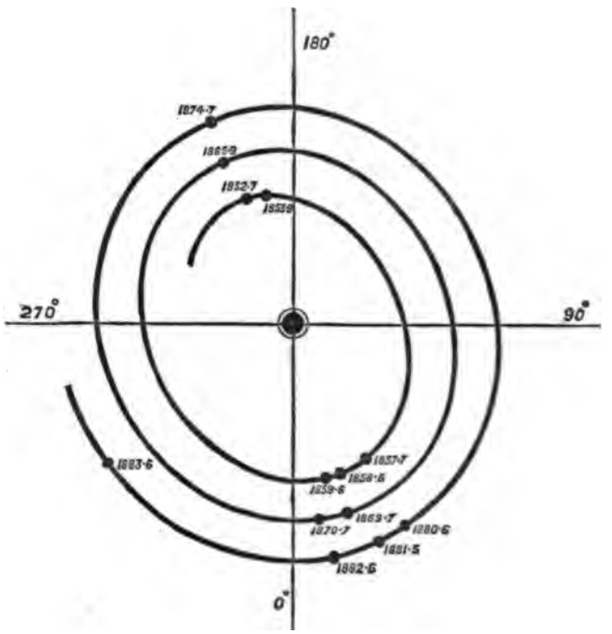
1882·616	12°·8	0″·32	—	V.
1882·531	10·4	0·29	—	V.
1882·753	6·1	0·26	—	V.
1883·542	308·9	0·20	—	V.
1883·559	302·8	0·23	—	V.
1883·562	311·0	0·21	—	V.
1882·63	9·8	0·29	3 nights.	
1883·55	307·6	0·21	3 „	

I have given particular attention to this interesting pair this year (1883), and made a good set of measures in a new quadrant from that in which all the prior measures have been made. The distance is so much less in this position that the pair would doubtless appear to be single with most of the telescopes heretofore used. The measures of the last four years are specially important in determining the direction of the smaller component of the system, and giving the general rate and direction of the motion, so that the prior scattered measures can be used in determining, roughly at least, the period of rotation. The magnitudes were carefully estimated, particularly in 1880, when the difference was very obvious, and I am certain that in all my measures the smaller star, B, is in the north following quadrant. With instruments much smaller than this, the difference in brightness in so close a pair would be hardly appreciable, and consequently some of the angles given in the earlier observations require a correction of 180°.

I have endeavoured to harmonise the various measures, and ascertain approximately the period. The distance never exceeds 0″·4, and all the measures, with the exception of those of 1883, have been made at about the maximum distance, and when the stars had nearly the same direction with reference to each other. The distances may therefore be repeated in this examination. The following are all the measures down to date, so far as I have been able to learn:—

1852·66	200°·6*	O Σ	2 nights.
1853·91	191·9	O Σ	1 night.
1857·67	29·5*	O Σ	2 nights.
1858·59	16·8	O Σ	1 night.
1859·65	13·5	O Σ	1 „
1865·91	203·3	O Σ	1 „
1869·74	15·6*	Harv. Coll.	6 nights.
1870·73	8·0	Du.	1 night.
1874·72	202·3*	O Σ	3 nights.
1880·60	29·1	β	5 „
1881·46	22·1	β	4 „
1882·63	9·8	β	3 „
1883·55	307·6	β	3 „

To the angles marked (*) a correction of 180° has been applied. In the following diagram the measures are represented, and, I think there can be no doubt, in the proper quadrant :—



β	Star.	R.A. 1880.	Decl. 1880.	P	D	Mags.	
		h m s	° ′	°	″		
1014	LL. 47287	0 1 23	+31 0	340	2·0	7·0...12·0	
1015	LL. 368	0 14 27	+11 39	100	0·5	8·5= 8·5	
1016	D.M. (32°) 324	1 42 52	+32 29	45	0·6	8·5... 8·5	
1017	... ...	6 6 28	− 2 55	180	0·8	8·7... 8·8	Found in looking for H. 383.
1018	LL. 11965	6 10 6	− 2 50	60	5·0	8·5...12·0	
1019	... ...	6 11 26	− 3 0	280	1·0	8·0... 9·5	
1020	W. VI. 387	6 15 46	+28 49	170	1·5	8·0...10·0	
1021	W. VI. 648	6 24 8	+28 28	120	0·8	8·0... 9·0	
1022	W. VI. 1557	6 53 15	+27 26	160	1·0	8·5... 8·5	
1023	D.M. (26°) 1498	7 7 45	+26 5	130	0·3	8·5... 8·5	Suspected.
1024	D.M. (29°) 1520	7 13 58	+29 35	110	1·0	9·0...11·0	
1025	LL. 45242	23 1 38	+12 1	270	1·0	8·0... 8·0	A B
				90	15·0	...12·0	A C

CORRECTIONS.

β 961 is identical with β 963. The seconds of R.A. should be 59^s, as given in the latter number. From the two sets of measures we have: 141°·4 : 8″·00 : 6·9...11·5 (1880·57), 7 nights.

β 973. The Declination should be +8° 35′ in place of +18° 35′.

β 1013. This is identical with β 775.

CHICAGO: *October* 13, 1883.

S. W. Burnham,

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DOUBLE STAR OBSERVATIONS

Made in 1877–8 *at Chicago with the* 18½*-inch Refractor of the Dearborn Observatory.*

COMPRISING:

I. A CATALOGUE OF 251 NEW DOUBLE STARS WITH MEASURES.

II. MICROMETRICAL MEASURES OF 500 DOUBLE STARS.

By SHERBURNE WESLEY BURNHAM, M.A

Double Star Observations made in 1877–8 *at Chicago with the* 18½*-inch Refractor of the Dearborn Observatory, comprising: I. A Catalogue of* 251 *New Double Stars with Measures; II. Micrometrical Measures of* 500 *Double Stars.* By SHERBURNE WESLEY BURNHAM, M.A.

INTRODUCTION.

THE astronomical observations contained in the following pages were made between July 22, 1877, and October 15, 1878, with the 18½-inch refractor of the Dearborn Observatory, and comprise a catalogue of 251 new double stars, and measures of 500 double stars already known, making a total of more than 1,400 micrometrical measurements.

As but little use has been made of the great Equatoreal since its erection in Chicago, and no publications have been issued by the Observatory, a brief description of the instrument and its accessories may be of interest.

HISTORICAL.

The Chicago Astronomical Society was organised in 1862. At that time an object-glass of 18½ inches was still in the possession of Messrs. Alvan Clark & Sons, which they had made for the University of Mississippi, and which was left upon their hands in consequence of the breaking out of the civil war of the rebellion. Steps were at once taken to secure what was then the largest object-glass in the world. Negotiations for its purchase were pending with other parties; but, by the prompt and decisive action of

the Hon. THOMAS HOYNE, the glass was secured and a contract made for a complete mounting, at a cost of about $18,000. This amount was raised by subscription, the persons subscribing thereby becoming members of the Astronomical Society. A massive tower, about 90 feet in height and attached to the building of the Chicago University, was erected, and the instrument, in the early part of 1864, put in position. The tower alone cost $30,000, the entire expense of which was defrayed by the generosity of a single citizen, the Hon. J. YOUNG SCAMMON. Mr. HOYNE, in his report as Secretary, giving a "history of the foundation of Dearborn Observatory," justly says of Mr. SCAMMON, "his name is associated, by his culture and love of art and science, with the rise and progress of nearly every school, scientific enterprise, benevolent institution, and work of material progress in Chicago since it had a beginning." Mr. SCAMMON has been President of the Astronomical Society from its organisation, and has liberally contributed towards the support of the Observatory. A meridian circle of 6 inches aperture, by Repsold, was subsequently purchased, with which, under the directorship of Professor T. H. SAFFORD, a zone of star observations was commenced for the great Catalogue of the German Astronomical Society. This work was suspended by the great fire of October 1871, and has not been resumed.

THE EQUATOREAL.

The Equatoreal has a clear aperture of 18½ inches and a focal length of 23 feet. The finder has an object-glass of 3¾ inches in diameter. The mounting is of the usual German form, and supported by a single block of stone resting on the top of the pier. It has a Bond spring-governor driving clock, which latterly has carried the instrument very steadily. At times I have found it necessary to increase the driving weight, and occasionally to overbalance the instrument, thereby reducing the resistance.

The right ascension and declination circles are respectively 20 and 30 inches in diameter, finely divided, and furnished with reading microscopes. On the outer portion of each circle coarse divisions in black on white ground have been painted, reading by similar verniers to minutes in right ascension and to 5′ of arc in declination. To the eye end of the telescope is

attached a small terrestrial glass of about 1½ inch aperture, with a ball and socket joint so that it can be directed to the coarse divisions of the declination circle. Two of the lenses of the erecting eye-piece were removed in order to shorten the focus and bring it, when directed to a point about 15 feet distant, within the limit of the draws of the glass. With the "bull's eye" lamp ordinarily used the instrument can be set in declination or a reading taken without leaving the eye end of the telescope. This reading glass can be instantly removed and attached to the opposite side of the main tube so as to be always convenient to the eye when the instrument is reversed. I have never found it necessary in a single instance to use the fine graduations of either the right ascension or the declination circle. The smallest stars have been identified without difficulty, and for all practical uses these divisions, put on with a brush, serve as well as the most expensive and finely graduated circles.

The right ascension circle can be read from the floor with the lamp, but in most positions it is troublesome to set in right ascension, for the vernier cannot be seen when the observer is within reach of the telescope. To obviate this difficulty and save time in an operation which has to be repeated many times each night, I have attached a device which, so far as I know, is new, and is so simple and efficient that a brief description of its construction may be of service to others.

At the eye end of the telescope, from an axis placed exactly at right angles to the plane described by the tube when moved in declination—in other words, parallel to the declination axis—is freely suspended a thin disk, in shape nearly a semicircle and about 10 inches in the longest direction. This carries an arm of about 7 inches radius, moving about a fixed pin near the middle of one side of the disk. To this arm is attached a tolerably sensitive level filled with red fluid and having a long bubble. Part of a circle is described on the disk, having for its centre the centre of motion of the level arm, and this is divided into hours and minutes of right ascension, as hereafter described, for three hours each side of the zero point, which is on a level with the centre of the circle when the telescope is in the meridian. The edge of the disk extends a little beyond, and is parallel with the divided part of the circle, and a friction wheel is attached to the extremity of the level arm with a projecting milled head. This wheel, having an elastic

surface of rubber, presses against the circular margin of the disk. By turning the head, the level arm is moved to and remains in any position of the scale. In setting on an object, the telescope is first set in declination and the arm moved on the proper side of the zero point a distance equal to the difference between the right ascension of the object and the sidereal time. The telescope is then moved in right ascension until the bubble comes to the middle of the level. In identifying a star it is only necessary to turn the arm until it is level, and add to or subtract from the sidereal time, as the case may be, the reading of the scale. My practice has been to set my watch at the beginning of an evening's work to sidereal time. The difference in rate for a few hours is of no practical consequence, and it is much more convenient than a chronometer. It is quite necessary that the axis from which the disk is vertically suspended should be exactly in position, and adjusting screws are necessary. For convenience I have placed this axis between the lower end of the finder and the main tube. The level has to be adjusted on the arm so that its axis is parallel with the line joining the centre of motion of the arm and the point at which the reading is made. When the axis of the disk is in its proper place and the level arm moved so as to bring the bubble into the middle, it will remain there with any motion of the telescope in declination, and give the same reading with the instrument reversed for equal distances from the meridian. The disk, with its attachments, can be instantly removed, or can be reversed with reference to its axis, so that, when the telescope is on the other side of the pier, the graduated side of the disk shall be presented to the observer. The value of the divisions of the scale, expressed in degrees for each 10 minutes of right ascension, were calculated by the formula

$$\sin a = \frac{\mathrm{R} \sin b}{\cos l},$$

where a is the meridian distance, b the altitude, and l the latitude of the place. These 10-minute spaces were then subdivided into five equal parts, making the 2-minute divisions in the first hour from the meridian equal to 0·045 of an inch. They are of course a little less as they recede from the zero point of the scale, but still are wide enough to give with

certainty the nearest minute. It is but the work of a moment to set on a star, or take position of an unknown object, without leaving the seat.

I have found this simple contrivance of the greatest service in actual work. It was roughly made of wood by myself as an experiment; but it has so completely answered the purpose that I have used it ever since. By some little modification it can be made to indicate the declination of the telescope as well as the right ascension.

THE MICROMETER.

The micrometer, made by Clark & Sons, is provided with five eye-pieces, the powers of which I have measured as follows:—

I	190
II	292
III	390
IV	638
V	925

In addition to the micrometer screw, there is, on the opposite side, a coarser screw, moving both wires for bisections or bringing the wires up to the star, and a rackwork by which the eye-piece can be moved by the wires at right angles to the axis of the telescope, and the object and the wires placed in the extreme edge of the field. There is no provision for changing the coincidence of the wires. The position circle is 8 inches in diameter, with two verniers. From transits of circumpolar stars I have adopted $11''.420$ as the value of one revolution of the screw. In the early part of the work a slightly lower value was assumed from information; hence some few measures of wide pairs, as printed in communications relating to special objects in various Periodicals, will be found to differ slightly from the measures as recorded here. In distances where the change is sensible, the proper correction has been applied.

CLASSES OF DOUBLE STARS OBSERVED.

At the outset I determined to confine my observations as closely as possible, first, to pairs which, by reason of their extreme closeness or inequality, were peculiarly within the province of a large aperture; secondly, to double stars which, from the above conditions or the neglect of observers, have been measured but rarely or not at all in the last thirty or forty years; and thirdly, to certain difficult pairs recently discovered, principally by Mr. ALVAN G. CLARK and myself.

The second class of stars alluded to is a large and varied one, comprising many examples from the oldest lists of double stars, in fact, all Catalogues since Sir WILLIAM HERSCHEL, as well as occasional modern discoveries. Many observers have gone on from year to year observing over and over again the same familiar stars, of which *Castor*, γ *Virginis*, ϵ *Lyræ* may be cited as examples. Not that those stars are not important, but that they have been observed at the expense of hundreds of others equally important, and in one sense more important, for the reason that so little is known of their true character. It is the more to be regretted because most of these well-known systems are extremely easy—so easy, indeed, with the apertures generally employed, that the work of measuring them would for that reason be to some extent uninteresting to many observers; and fine refractors of 6 or 7 inches aperture and upwards ought, it would seem, to do more than deal only with couples which a 3-inch aperture will show perfectly. Many series of measures have been published from time to time, made with first-class instruments, which do not contain half a dozen stars each beyond the reach of an aperture giving one-third of the light. The result of all this is, that we have a large number of measures of a comparatively small list of stars, sometimes several hundred individual observations each, and only a very limited number, often none at all, of recent measures of a very much larger list. Of the four or five thousand double stars now known—leaving out the wide, faint, and apparently insignificant objects incidentally picked up in the sweeps of Sir JOHN HERSCHEL—the real character and rate of the relative motion, if any exists, of but a few dozen are understood.

In this connection I cannot forbear allusion to one distinguished observer who has followed no beaten track, whose indefatigable zeal is manifested in

every field, whose skill as an observer, if it has been equalled at any time, has never been excelled. The notes to the following measures will furnish some evidence of the wide range and the importance of the observations of Baron Dembowski. While he has systematically observed, each year for a long time, most of the more important of the old binary systems, he has found time to measure a large number of the most difficult pairs from the Catalogues of Struve I., Struve II., Herschel, and recent observers. The address of Lord Lindsay, President of the Royal Astronomical Society, in awarding the gold medal to Baron Dembowski in the early part of the present year, contains a brief account of his labours; but it is probably not generally known that his micrometrical measures of a large number of important pairs are as yet unpublished. In the interest of my General Catalogue of Double Stars, I have been favoured with perhaps several thousand measures altogether, not included in his printed observations. For several years he has given no inconsiderable portion of his time to measuring the new pairs discovered by myself with the 6-inch refractor. Of these double stars—upwards of 400 in number—not less than 1,500 measures have been made, only a few of which have been published. It is to be hoped that at an early day Baron Dembowski will publish his observations in a complete form. They are scattered through many volumes of the *Astronomische Nachrichten*, and are apt to be overlooked without a systematic search for particular stars. Omit the observations of Dembowski and O. Struve, and our knowledge of nine-tenths of the double stars would not be materially advanced in the last thirty years.

Some of the new pairs in the accompanying Catalogue have been measured by Baron Dembowski, and I am fortunate in being able to present his measures in addition to my own. Few observers would be able to measure such stars and those habitually observed by him with an aperture of only 7 inches. It is another illustration of the truth that much more depends upon the observer than the size of the instrument. I may add that nothing has been more gratifying and flattering to me than to find my measures of a difficult pair with 18½ inches aperture agreeing closely with the measures of Baron Dembowski with 7 inches.

METHODS OF OBSERVATION.

In making my measures I have used almost exclusively a bright wire illumination, and always red light. While I do not know that the latter is indispensable, I have found it so satisfactory that I have not tried any other colour. With the proper amount of light from the right direction I find the wires smaller and sharper than with a bright field, and the illumination does not injuriously affect the visibility of the faintest stars. I have found it true that many, if not most, of the minute stars measured are more obvious under a suitable illumination of this kind than with the lamp removed altogether. I have never seen a star so faint that it could not be equally well seen with a sufficient illumination to show the wires with desired distinctness.

The micrometer is furnished with two hollow arms on opposite sides of the main tube, making an angle of about 45° with the optical axis of the telescope, from which the lamp is suspended. These arms are attached to a collar which revolves about the fixed tube of the micrometer, the light passing through a series of holes in the latter and striking the wires directly. The colour of the light is produced by a slip of red glass moving in a slot in front of the lamp in such a manner as to regulate the quantity of light as well as the intensity of the colour. In making a measure of either distance or angle, these arms are turned so as to bring them approximately into the plane of the micrometer screw. The light then strikes the wires at right angles and produces the strongest illumination. A constant position of the lamp with reference to the wires is doubtless important, and certainly tends to make the observations uniform. The lamp can be readily shifted so as to give a bright field; but I have been unable to find in my own observations any special advantage in this method, even with bright stars.

Most of the close pairs, and generally those under 1″, have been measured with the highest power. Eye-piece I has been very rarely used, and II only in measuring wide pairs on poor nights. Most of the measures have been made with III, IV, and V. I have not indicated the power used in each measure, as it could be of little interest to other observers. With regard to the use of powers, much depends upon the quality and aperture of

the telescope and the atmospheric conditions at the particular time, and something upon the eye and habits of the observer.

In regard to the manner of observing, it should be stated that the Observatory is provided with no seat or couch for zenith observations or measuring stars in high altitudes, and it has been impossible for me to give that attention, in making measures, to the position of the head and body of the observer that the most experienced observers consider important. For moderate altitudes I have used a step-ladder, making each step a tolerably comfortable seat by the simple expedient of placing a box on the step below equal in height to the distance between the successive steps. This has answered reasonably well for zenith distances not less than 25° or 30°. I shall provide myself with better facilities for the next series of measures.

The method of double distances has always been employed, except in perhaps half a dozen instances of remote stars, which are noted in the measures. I have usually taken five readings for position and three on each side for distance. Shortly after commencing work I found there was some "shake" in the micrometer screw, and in the few measures made prior to that time (1877·681) I have rejected those of distance or given them to a single decimal place. The micrometer was then put in good order, and has so remained.

As to the performance of the telescope, the discoveries and measures themselves are the best evidence. I will only add that the object-glass, now that it is in much more perfect adjustment than it has been for many years, is fully up to the standard of excellence found in all the refractors manufactured by Messrs. Alvan Clark & Sons. The separating power is nearly, if not quite, what it should be in accordance with the formula of DAWES—

$$\frac{4''\cdot54}{\text{Aperture}}.$$

With the highest power and under favourable conditions, I think it will fairly separate two equal stars with a distance of 0″·25.

STAR MAGNITUDES.

In the magnitudes assigned to the smaller stars of the new pairs there is some room for doubt. When they do not fall below 12 of the scale employed (Struve's) I have not felt much hesitation, because standards of comparison are familiar. The tendency would probably be, in using a large aperture, to overestimate the brightness; but when stars that are faint in such an instrument, and more or less difficult from their proximity to bright objects, are to be estimated, the absence of the practical extension of any scale to such limits renders the values somewhat uncertain, however consistent they may be with each other. Professor Pickering, of the Harvard College Observatory, has commenced a series of photometric observations of double stars with comparisons running down to the limit of visibility with the 15-inch refractor. This systematic work cannot fail to be of the highest importance. Even a few of these small stars, with the magnitudes absolutely determined by the methods employed by Professor Pickering, will be of great assistance, by enabling the observer to have in his own mind some standards with which to compare.

MEASURES OF OLD DOUBLE STARS.

In preparing a working list I have been guided by the principles and considerations already mentioned. But, in order to fill up all the time, it was necessary that a considerable portion of this list should consist of wide pairs, such as could be observed when the weather was unsuitable for more interesting and difficult objects. In selecting these I have taken such as seem the most important from the absence of any recent observations. I have usually observed on each night the most difficult and close pairs I could measure under the circumstances. The very best nights have been given to pairs under $0''.4$, or, if very unequal, under $1''$. The magnitudes given in the eighth column of the measures are taken from the original Catalogue in which the pair is first found, with the exception of the $O\Sigma$ pairs, the magnitudes of which are from Dembowski's measures of the Pulkowa Catalogue.

NEW DOUBLE STARS.

Much less time has been given to the discovery of new objects than might be supposed necessary from the number of new systems in the following pages. When the time required to make more than 1,400 micrometrical measures is taken into account, it will be seen that no very large proportion, relatively, could remain for new fields. Many of the new doubles are naked-eye stars, and some of them of the most interesting class.

The following is a list of 51 naked-eye stars whose distances are within the limits adopted by STRUVE, with the corresponding Catalogue number :—

β	Star.	Distance.	β	Star.	Distance.
491	δ Andromedæ	27·86	616	γ Boötis	26·18
492	B.A.C. 201	1·82	618	ι^1 Libræ	1·86
506	η Piscium	1·02	625	ω Herculis	1·90
513	48 Cassiopeiæ... ...	1·07	627	52 Herculis	1·83
518	Ceti 389	1·57	633	γ Draconis	20·88
521	Persei 67	5·86	637	W^1 XVIII. 28 ...	7·26
522	μ Arietis	19·10	648	B.A.C. 6480	0·61
524	20 Persei	0·34	653	μ Aquilæ	21·
531	L 6275...	2·43	654	52 Sagittarii	2·93
535	38 Persei	0·96	660	B.A.C. 6963	9·44
544	36 Tauri	25·06	668	B.A.C. 7080	4·64
547	47 Tauri	0·89	669	ω^2 Cygni	17·26
550	α Tauri	30·45	672	71 Aquilæ	30·52
553	o^2 Orionis	28·58	675	51 Cygni	2·78
555	β Orionis	0·2	685	2 Pegasi	29·82
570	11 Monocerotis ..	25·79	690	μ Cephei	19·27
578	L 14545	1·72	694	Lacertæ 4	0·50
587	15 Hydræ	0·45	697	19 Cephei	19·75
588	Hydræ 96	2·37	702	δ Cephei	19·37
590	29 Hydræ	10·80	703	α Lacertæ	30·16
596	Leonis 222	2·38	717	8 Andromedæ	7·61
599	65 Leonis	1·78	718	64 Pegasi	0·46
600	Crateris 36	1·25	720	72 Pegasi	0·40
605	B.A.C. 4149	1·25	730	27 Piscium	1·42
608	15 Canes Ven... ...	1·22	733	85 Pegasi	0·67
612	B.A.C. 4559	0·23			

In conformity with my experience heretofore, a number of previously known double stars from the various Catalogues have been found to have other and closer components. In most instances the difficulty of the object will account for its non-discovery by prior observers. The following is a list of 35 such pairs, with the distances of the old and new companions and the corresponding number in my Catalogue:—

β	Double Star.	New.	Old.	β	Double Star.	New.	Old.
487	Σ 17	2″·04	27″·06	600	♅ N. 26 = Sh. 120 ...	1″·25	61″·53
510	♅ V. 92	1·59	53·56	601	♅ IV. 112 = S. 627 ...	0·81	28·16
511	Σ 171	3·69	29·69	608	Σ 24 App. I. (15 Canes Venatici)	1·22	288·30
524	Σ 318 (20 Persei) ...	0·34	14·04				
530	Σ 366 *rej.*	1·99	48·97	614	OΣ 271	0·60	...
536	S. 437	0·44	36·72	617	S. 663 = ♅ VI. 117 ...	2·73	59·44
550	Σ 2 App. II. (Aldeb.) .	30·45	113·9	618	♅ VI. 44 (ι Libræ) ...	1·86	57·46
551	H. 3261 (96 Tauri) ...	6·26	30·75	620	H. 4803	0·86	50·25
555	Σ 668 (β Orionis) ...	0·2	9·14	632	OΣ 336	5·46	42·80
557	Σ 721	0·46	24·32	638	Σ 2287	1·71	22·33
558	Σ 14 App. I. (δ Orionis)	33·79	52·80	639	Sh. 264	0·5	17·30
559	H. —	1·74	50·85	643	Σ 2342	8·86	28·80
575	Σ 1057	0·69	15·87	652	Σ 2539 = ♅ II. 99 ...	4·78	5·60
579	OΣ 173	0·84	16·60	655	Σ 2549	1·93	22·86
580	Pollux	...	...	686	OΣ (App.) 220 ...	0·4	41·67
582	Σ 1179	3·76	19·75	702	Σ 58 App. I. (δ Cephei)	19·37	40·48
584	S. 571	1·61	44·97	713	Σ 2959	8·31	13·77
587	♅ V. 120 (15 Hydræ).	0·45	45·75	733	— (85 Pegasi) ...	0·67	14·40

The date of the discovery of the new stars is generally that of the first measure. The reference number in the first column is continued from the preceding series of Catalogues of new double stars, which have been published as follows:—

First Catalogue	Nos. 1 to 81	*Monthly Notices R.A.S.*	March 1873.
Second „	„ 82 „ 106	„ „	May 1873.
Third „	„ 107 „ 182	„ „	December 1873.
Fourth „	„ 183 „ 229	„ „	June 1874.
Fifth „	„ 230 „ 300	„ „	November 1874.

Sixth Catalogue	Nos. 301 to 390	*Astronomische Nachrichten*,	No. 2062.
Seventh „	„ 391 „ 436	„ „	No. 2103.
Eighth „	„ 437 „ 452	*American Journal of Science*	July 1877.
Ninth „	„ 453 „ 482	*Monthly Notices R.A.S.*	December 1877.

The present work forms the tenth Catalogue of the series, and extends the number of new pairs to 733.

Of the 251 stars in this list, 75 pairs are from 0″ to 1″ in distance, and 59 pairs from 1″ to 2″.

The weather during the period covered by these observations has been very unfavourable much of the time. For weeks together there has not been a single good night. Two evenings each week the instrument has been at the service of visitors.

I have made a few observations in other directions, but they are of minor interest, and, with the exception of the two new nebulæ, are not included in the results here given. I have intended to give my whole time to the more important and extensive field of double-star work, and particularly to that portion of it most worthy of so large a refractor, now best known as the instrument with which the companion of *Sirius* was discovered by Mr. Clark in 1862.

In conclusion, I may add that my work has been wholly a labour of love. During the business hours of every day I have been otherwise fully occupied, and hence my observations have been prosecuted often at the expense of rest, sleep, and recreation. I submit the results to the Royal Astronomical Society as the first contribution of the great Equatoreal of the Dearborn Observatory.

Chicago, October 15, 1878.

ABBREVIATIONS USED IN THE NOTES.

Arg.	*denotes*	Argelander.
A. C.	„	Alvan Clark.
A. G. C.	„	Alvan G. Clark.
β	„	Burnham.
Da.	„	Dawes.
De.	„	Dembowski.
Du.	„	Duner.
En.	„	Engelmann.
Flm.	„	Flammarion.
Gl.	„	Gledhill.
$\mathfrak{H}$	„	Herschel I.
H.	„	Herschel II.
Hd.	„	Harvard College Observatory.
Hl.	„	Hall.
Hn.	„	Holden.
J.	„	Jacob.
Kn.	*denotes*	Knott.
Ma.	„	Mädler.
Mh.	„	Mitchel.
Mu.	„	*Annalen König. Stern. München*, xvii.
Ne.	„	Newcomb.
Σ	„	Struve.
$O\Sigma$	„	Otto Struve.
O. S.	„	Ormond Stone (including measures of H. A. Howe and Winslow Upton).
Se.	„	Secchi.
Sh.	„	South and Herschel.
Shp.	„	Schiaparelli.
Sm.	„	Smyth.
Wn.	„	Winnecke.
W. S.	„	Wilson and Seabroke.

I.—*Catalogue of* 251 *New Double Stars.*

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
483	L. 47348	0 2 49	40 11	44·7	2·37	7·5 ... 11·8	8·657	One of a wide pair.
484	Arg. (51°) 9 ...	0 3 30	51 22	154·1	1·92	8·0 ... 12·0	8·647	
				158·4	1·99	7·5 ... 11·8	8·673	
485	Arg. (57°) 22 ...	0 4 30	58 6	145·7	0·3 ±	8·5 ... 8·5	7·553	
				151·3	0·41	9·0 ... 9·2	8·796	
486	Ceti 33	0 8 19	−8 27	3·4	3·35	6·0 ... 11·5	7·775	
				6·7	2·80	6·0 ... 12·0	8·701	
487	Σ 17	0 10 18	28 38	29·1	...	8·0 ... 9·2	7·731	A and B.
				28·7	27·06	8·0 ... 9·5	8·775	
				264·7	1·93	12–13	7·731	B and C.
				266·1	2·16	12·5	8·775	
488	L. 465	0 17 52	−4 8	347·7	3·30	8 ... 11	7·703	
				346·7	3·25	7 ... 10·5	8·594	
				348·5	3·31	7·5 ... 10·0	8·610	
				348·8	3·43	... ...	8·701	
489	Arg. (43°) 80 ...	0 19 40	43 31	178·8	2·5 ±	8·5 ... 11	7·785	Very poor.
				187·7	3·43	8·0 ... 12·5	8·671	
490	13 Ceti	0 29 3	−4 15	65·3	37·12	6 ... 12–13	7·780	Difficult.
491	δ Andromedæ ...	0 32 54	30 12	298·9	27·98	3 ... 12·5	7·725	
				300·7	27·86	... ...	8·742	
				298·4	27·74	... ...	8·744	
492	B.A.C. 201 ...	0 38 28	54 34	153·5	1·82	6 ... 12	8·671	
				151·7	2·01	6 ... 12	8·796	
493	Arg. (50°) 137 ...	0 39 4	50 27	51·1	0·8 ±	9·0 ... 9·0	7·586	
				51·7	0·83	9·2 ... 9·2	8·671	
				52·6	0·88	... ...	8·673	
494	L. 1266	0 40 52	−1 54	166·3	1·42	8 ... 8	7·703	
				170·6	1·35	8·2 ... 8·2	8·701	
495	L. 1308	0 42 25	18 2	230·9	0·58	7·5 ... 7·5	8·701	
496	L. 1416	0 45 17	12 8	1·9	5·18	6 ... 12–13	8·701	8 mag. in L. and 7 mag. in Arg.
				2·9	5·06	7 ... 13	8·775	
497	B.A.C. 239 ...	0 45 55	60 28	171·6	121·20	6·0 ... 9·0	8·663	A and B.
				150·9	0·9	9·0 ... 11–12	7·586	B and C.
498	L. 1459	0 46 33	9 9	155·3	2·50	8 ... 12–13	7·742	
				157·2	2·56	8 ... 12	8·775	
499	γ Cassiopeiæ ...	0 48 50	60 1	348·7	52·22	3 ... 13	8·647	Two brighter in 175°·7 and 198°·1.
				348·5	52·33	13	8·796	

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
500	L. 1539	0 48 51	30 1	291·7	1·17	8·0 ... 8·0	7·969	
				286·2	0·92	8·3 ... 8·3	8·747	Unsteady.
501	L. 1958	1 0 40	− 5 17	30·5	2·25	8·0 ... 11·0	8·206	
				29·3	2·85	8·0 ... 12·5	8·775	
502	W[1] O. 1077 ...	1 2 13	15 9	306·6	3·58	8 ... 11–12	7·818	
				306·7	3·40	8·2 ... 11·5	8·775	
503	L. 2307	1 10 54	9 58	136·9	5·39	7–8 ... 12–13	7·742	
				136·4	5·53	8 ... 12	8·627	
				136·9	5·40	8 ... 11·5	8·775	
504	L. 2318	1 11 9	1 13	274·2	1·27	8·0 ... 11·5	7·942	
				280·4	1·54	7·5 ... 12·0	8·775	
505	θ Ceti	1 18 2	− 8 48	60·5	58·8	3 ...	7·703	Excessively faint.
506	η Piscium ...	1 25 4	14 44	15·3	0·91	4 ... 11	8·675	Small star blue.
				10·3	1·11	4–5 ... 11	8·733	
				13·0	1·03	11	8·775	
507	Arg. (26°) 264 ...	1 29 16	26 10	155·5	2·28	7·5 ... 10·0	7·736	8·6 in Arg.
508	Arg. (26°) 276 ...	1 32 26	26 20	71·1	1·02	9·0 ... 9·5	7·725	
509	L. 3170	1 37 25	8 58	98·7	0·90	8·5 ... 9·0	7·742	
				88·6	0·64	8·5 ... 8·7	8·733	
				93·1	0·60	8·2 ... 8·5	8·775	
510	ℍ V. 92	1 42 4	15 43	337·4	1·59	8 ... 12	8·063	A and B.
				326·4	53·56	8	8·063	A and C.
511	Σ 171	1 42 40	− 2 1	160·2	29·92	8·5 ... 8·5	7·859	A and B.
				160·1	29·47	... ...	7·953	
				159·2	29·67	8·4 ... 8·5	8·775	
				316·7	3·53	12–13	7·859	B and C.
				318·0	4·15	... ...	7·953	
				313·3	3·38	12·5	8·775	
512	Arg. (18°) 244 ...	1 47 12	18 42	31·8	1·8	9 ... 12–13	7·678	
				25·5	1·42	... ...	7·695	
				24·5	1·48	9 ... 13	8·675	
513	48 Cassiopeiæ ...	1 52 7	70 19	264·9	1·25	5 ... 7	8·649	A and B. Very unsteady.
				262·8	0·90	5 ... 7·5	8·660	
				265·5	0·98	5 ... 8	8·796	
				49·4	23·98	13–14	8·796	A and C.
514	L. 3698	1 53 57	−13 54	285·5	6·20	8 ... 12	7·695	
515	L. 3707	1 54 38	15 59	241·7	1·58	7·5 ... 12–13	8·030	
				244·9	1·44	8 ... 12	8·733	
516	L. 3851	1 59 6	− 1 33	104·0	1·17	8·0 ... 8·3	7·862	
				286·0	0·98	8·0 ... 8·2	7·994	
517	Ceti 374	2 18 54	− 4 26	248·4	10·82	7·5 ... 12–13	7·994	L. 4476.

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
518	Ceti 389	2 23 11	9 2	138·8	1·27	6–7...10·5	7·882	B.A.C. 764.
				139·2	1·87	7·0 ...11·0	7·994	
				137·3	1·57	6–7...11·5	8·030	
519	W¹ ii. 367 ...	2 23 38	− 2 48	237·7	0·97	8·5 ...10·5	7·942	
520	L. 4858	2 30 49	− 4 6	207·7	0·6 ±	9·0 ...10·5	7·942	Poor measure.
				214·7	0·78	9·0 ...10·5	7·994	
521	Persei 67 ...	2 34 59	47 45	153·2	5·80	6·5 ...11·0	8·649	L. 4942.
				154·3	5·92	6·0 ...11·5	8·671	
522	μ Arietis	2 35 36	19 30	265·8	19·10	6 ...12–13	8·747	
523	Arg. (33°) 517 ...	2 41 54	33 28	210·3	2·25	9·0 ...11·0	7·850	In field with Σ 310.
524	20 Persei ...	2 46 9	37 51	185·9	0·25 ±	... ...	8·096	A and B. Suspected elongation.
				157·7	0·39	... ...	8·655	Certainly double distance too large.
				158·6	0·36	6 ... 7	8·657	Well seen. Distance too large.
				159·7	0·26	6 ... 7	8·675	
				236·1	14·04	... ...	8·151	AB and C = Σ 318.
525	B.A.C. 920 ...	2 52 0	21 8	105·1	0·59	7·0 ... 7·0	7·717	
526	β Persei	3 0 21	40 30	154·8	59·37	B = 13	7·736	A and B.
				155·8	58·21	... ...	8·649	
				144·2	67·83	C = 13+	7·736	A and C.
				145·2	67·62	... ...	8·649	
				192·7	81·99	D = 10	7·736	A and D.
				192·4	81·86	... ...	8·649	
				114·6	10·51	E = 12·5	7·736	D and E.
				115·6	10·77	... ...	8·649	
527	W¹ ii. 1057 ...	3 0 35	−13 43	60·4	0·85	8·0 ... 8·5	7·829	Closely *sp.* Σ 356.
528	W¹ ii. 1086 ...	3 2 26	− 4 3	193·8	1·01	8·5 ... 8·5	7·942	In field with Σ 358.
				201·2	1·02	8·5 ... 8·5	7·994	
529	L. 6006	3 8 9	− 9 1	220·4	2·17	8·0 ...12·0	7·698	
				219·5	2·62	... ...	8·091	
530	Σ 366 *rej.* ...	3 8 17	22 30	42·1	48·93	7	7·728	A and B.
				41·3	49·02	... ...	8·063	
				195·2	2·11	10·0 ...11·0	7·728	B and C.
				197·5	1·86	... ...	8·063	
531	L. 6275	3 17 26	− 8 13	62·2	2·84	7 ...12–13	7·829	In Heis, 6–7 m.
				58·1	2·02	6·5 ...12·0	7·994	
532	L. 6585	3 27 25	−10 27	263·4	3·58	7½ ...12 +	7·698	A and B.
				269·3	2·57	... ...	8·091	
				310·1	80·4	8	7·698	A and C.
533	B.A.C. 1101 ...	3 28 9	31 17	149·3	0·43	7·0 ... 7·0	8·675	6½ m. in B.A.C.
534	L. 6741	3 33 1	− 8 54	195·0	2·58	7½ ...10·5	7·810	
				197·5	2·05	7 ...10·5	7·947	

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
535	o, 38 Persei ...	3 36 47	31 54	54·8	1·00	... ...	7·678	
				58·6	0·44	... ...	8·030	
				55·9	0·96	... ...	8·657	
				57·9	0·93	4 ... 8·5	8·657	
536	W² iii. 945 ...	3 39 8	23 49	339·3	0·47	8·5... 9·0	8·657	A and B.
				333·1	0·46	8·0...10·0	8·675	
				336·8	0·39	8·5... 9·0	8·733	
				302·3	36·85	8·0	8·675	AB and C.
				302·6	36·59	8·0	8·733	
				11·2	18·17	12	8·675	C and D.
537	Arg. (24°) 563 ...	3 39 53	24 28	189·1	0·64	8½ ...12	7·717	
				182·7	0·57	8·5... 9	8·096	
538	Yar. 1634 ...	3 40 21	23 44	138·0	2·27	10 ...11	7·728	
539	W¹ iii. 809 ...	3 43 11	− 1 52	270·4	2·79	9·0...11·0	7·818	Near β 401.
				273·9	2·79	... ...	7·953	
540	Arg. (31°) 669 ...	3 48 21	31 48	323·8	1·34	8 ...11	8·655	A and B.
				328·2	1·10	8·2...12·0	8·657	
				57·1	57·51	8	8·655	A and C.
				57·3	56·77	8·5	8·742	
541	W¹ iii. 923 ...	3 49 53	− 1 37	259·8	1·34	8·5...10·5	7·953	
542	Anonymous ...	3 50 23	− 7 18	198·4	1·65	9 ...10	7·859	
543	W¹ iii. 974 ...	3 51 24	− 1 30	32·0	11·15	8·5...10·5	7·818	
544	36 Tauri	3 57 11	23 47	257.0	25·06	6 ...12–13	7·856	
545	L. 7556	3 59 24	37 42	312·3	0·92	8·0...11·0	7·736	
				307·7	1·10	... ...	7·882	
				307·6	1·16	8·0...11·5	8·665	
				312·6	0·92	8·0...12·0	8·671	
546	W² iii. 1323 ...	4 2 49	41 28	24·3	0·92	8 ... 8	8·671	
547	47 Tauri	4 7 25	8 58	352·6	...	... ...	7·678	
				363·4	...	... ...	7·818	Clouded before distance.
				362·1	0·89	5 ... 8	8·030	
				223·1	32·20	12–13	7·994	AB and C.
548	L. 8027	4 10 53	−10 23	347·0	6·24	7 ...11–12	7·862	
549	W¹ iv. 458 ...	4 23 2	−12 13	189·3	7·71	8 ...12–13	7·942	
				188·7	8·00	... ...	8·003	
550	α Tauri (Aldebaran)	4 29 2	16 16	111·6	30·26	... ...	7·829	B = 13–14 m.
				103·3	30·72	... ...	7·856	
				112·1	30·38	... ...	7·994	
				35·2	114·66	... ...	7 870	Hl's companion.
				35·2	114·34	... ...	7·950	
551	96 Tauri	4 42 52	15 42	57·2	30·75	... ...	8·091	A and B.
				205·7	6·26	... ...	8·091	B and C.

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
552	Orionis 11 ...	4 45 3	13 27	360·±	0·8 ±	7 ...10	7·966	
553	o^2 Orionis ...	4 49 38	13 19	47·3	28·35	5 ...12	7·856	
				48·1	28·81	... ...	7·873	
554	ϵ Aurigæ	4 53 21	43 39	275·9	42·88	4 ...12	8·046	A and B.
				275·0	...	12	8·796	
				317·9	51·79	13	8·796	A and C. Very unsteady.
555	β Orionis... ...	5 8 47	− 8 20	160·3	...	... ...	8·091	B and C. Not much doubt. Certainly double.
				179·1	0·31	... ...	8·153	
				178·9	0·40	... ...	8·170	
				1·7	44·53	12–13	7·810	A and D.
				1·3	44·42	... ...	7·829	
556	L 10159	5 18 39	− 2 36	238·2	0·79	6½ ...11·8	8·170	
557	Σ 721	5 23 16	3 3	149·8	24·32	7·0... 9·0	8·153	A and B C.
				143·1	0·43	9·5... 9·5	8·153	B and C.
				141·8	0·50	... ...	8·170	
558	δ Orionis	5 25 52	− 0 23	226·2	32·46	B = 13–14	7·829	
				228·6	34·71	... ...	7·856	
				226·1	34·20	... ...	7·994	
				359·5	52·80	2·0... 6·8	7·994	Σ's companion.
559	... ...	5 40 36	0 2	82·1	1·78	9·0...11·5	8·096	A and B.
				88·5	1·70	... ...	8·156	
				202·5	50·70	9·0... 9·0	8·096	A and C.
				201·6	51·00	... ...	8·156	
560	L. 10958	5 41 37	29 41	208·2	0·94	8·0... 8·0	7·882	Poor measure.
561	L. 10969	5 41 58	12 23	4·0	19·70	7 ...13	8·093	
562	L. 11127	5 47 41	36 55	110·±	0·3 ±	8 ... 8	8·047	
563	L. 11156	5 47 46	15 29	183·9	7·42	7·8...11·0	8·063	
564	Lam. 843... ...	5 54 59	− 1 34	90·±	1·±	9·0...11·0	7·953	Difficult.
565	L. 11741	6 3 41	−14 3	100·4	1·02	8 ...12	8·211	7½ m. in L. and W.
566	Monocerotis 21 ...	6 8 41	− 4 32	219·7	1·43	8·5...12–13	8·030	L. 11916.
567	Monocerotis 23 ...	6 9 34	− 4 53	249·0	4·12	7·5...11·5	8·030	L. 11949.
				251·1	3·46	... ...	8·156	
568	Canis Majoris 33	6 18 36	−19 43	155·1	1·35	7·0... 7·3	8·211	
569	L. 12315	6 19 36	−10 52	120·7	1·84	8·2...10·5	7·994	
570	11 Monocerotis ...	6 23′ 0	− 6 57	57·3	25·52	5 ...12–13	7·856	A and D.
				55·3	25·88	... ...	8·030	
				55·8	25·98	... ...	8·170	
571	W^2 vi. 956 ...	6 33 2	13 5	316·2	2·73	6·0...12·0	7·947	In Heis, 6–7 m.
572	O^1. Arg. 6032 ...	6 55 44	−20 30	143·8	5·03	7·0...10·5	7·876	
573	L. 13642	6 56 11	−10 42	...	1·±	8 ... 8	7·856	
574	L. 13821	7 1 18	−11 8	306·7	1·76	8 ...12	8·041	Near Σ 1026.

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	°	°	"			
575	Σ 1057	7 9 21	−15 16	198·2	0·85	8 ... 8	8·153	A and B.
				200·3	0·53	... ...	8·214	
				2·6	15·95	9·8	8·036	AB and C.
				1·7	15·80	... ...	8·153	
576	L. 14117	7 11 5	35 23	143·1	1·48	7 ...13	8·046	
577	L. 14272	7 14 21	0 38	136·8	0·90	7·5... 7·7	8·211	A and B.
				9·9	14·54	13	8·211	AB and C. AB = Σ 1074.
578	L. 14545	7 21 46	−17 37	53·6	1·72	6·5...11·8	8·197	In Heis, 6 m.
579	OΣ 173 *rej.* ...	7 26 40	33 23	219·1	0·84	8·0...11·5	8·236	A and B.
				232·2	16·60	12·0	8·236	A and C.
580	Pollux	7 38 1	28 19	274·9	43·0	2 ...13–14	7·953	A and B.
				70·8	172·1	... ...	8·063	A and C.
				70·8	174·52	... ...	8·230	
				123·4	1·±	10 ...12–13	8·063	C and *c*.
				132·6	1·40	... ...	8·153	
				90·5	...	... ...	8·230	A and D.
				75·8	...	... ...	8·230	A and E.
581	L. 15743 ...	7 57 44	12 38	176·9	0·40	8 ... 8	8·088	A and B.
				176·9	0·39	... ...	8·227	
				183·3	4·55	10·5	8·088	AB and C.
				189·4	5·01	... ...	8·091	
				183·3	4·71	... ...	8·227	
582	Σ 1179	7 58 6	12 25	204·8	19·76	8½ ... 8½	8·088	A and B.
				204·3	19·75	... ...	8·091	
				60·7	3·87	12	8·088	B and C.
				58·9	3·66	... ...	8·091	
583	L. 15959	8 3 18	− 6 21	68·5	1·82	8·5... 8·7	8·099	
584	P. viii. 124 ...	8 32 58	19 58	292·2	1·76	8·0...12·0	8·030	A and B.
				289·9	1·46	... ...	8·068	
585	Cancri 109 ...	8 34 20	20 54	101·8	0·3 ±	8 ... 9	8·068	Poor measure.
				110·9	0·40	7·5... 9·0	8·153	
586	Monocerotis 237 ...	8 41 49	−16 37	53·2	0·75	6·5... 9·0	8·153	L. 17355.
587	15 Hydræ ...	8 45 41	− 6 44	158·1	0·48	6 ... 9	8·156	A and B.
				161·8	0·43	... ...	8·227	
				357·4	...	... ...	8·099	A and C.
				356·2	45·75	... ...	8·186	
				54·2	...	... ...	8·099	A and D.
				52·2	49·99	... ...	8·186	
588	Hydræ r96 ...	9 10 30	1 14	122·6	2·33	6½ ...11·0	8·170	In Heis, 6-7 m.
				123·9	2·42	6½ ...11·0	8·211	L. 18302.
589	L 18585	9 20 15	7 3	219·1	2·30	7½ ...12–13	8·088	

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
590	29 Hydræ ...	9 21 22	− 8 42	175·5	10·68	7·0...11·5	8·131	
				178·2	10·93	6½ ...12·0	8·211	
591	W¹ ix. 477 ...	9 23 33	− 2 36	35·5	0·78	7·7... 8·5	8·063	Near τ Leonis
				36·1	0·68	... ...	8·153	
592	O¹. Arg. 10209 ...	9 49 16	−15 38	192·5	9·56	6½ ...12–13	8·225	7 m. in O. Arg.
				191·2	10·04	... ...	8·227	
593	γ Hydræ	10 4 4	−11 46	118·4	50·76	... ...	8·236	Faint companion.
594	Leonis 150 ...	10 16 20	15 58	143·4	1·58	6·0...10·5	8·244	
595	Anonymous ...	10 42 ±	−14 23 ±	14·6	2·32	9·0...11·0	8·208	
596	Leonis 222 ...	10 43 2	17 47	280·6	2·59	6½ ...13	8·244	L. 20827.
				274·1	2·18	... ...	8·285	
597	Arg. (24°) 2285 ...	10 49 17	24 14	46·4	0·91	8·5...11·0	8·208	
				47·4	0·85	... ...	8·246	
598	59 Leonis ...	10 54 32	6 45	220·9	46·76	5½ ...	8·236	Faint.
599	65 Leonis ...	11 1 50	2 30	85·1	1·68	5½ ...11·5	8·046	
				84·0	1·93	...11·5	8·208	
				78·3	1·93	... ...	8·244	
				82·1	1·59	... ...	8·285	
600	ℍ N. 26	11 10 54	− 6 29	226·4	1·25	6½ ...12·0	8·153	A and B.
				97·3	61·72	8	8·153	A and C.
				97·3	61·34	... ...	8·208	
601	ℍ IV. 112 ...	11 22 54	−16 40	331·6	28·01	7·5	8·323	A and B.
				331·4	...	... ...	8·353	
				331·5	28·32	... ...	8·359	
				226·9	0·81	8·0... 9·0	8·323	B and C.
602	L. 22262	11 40 39	15 40	73·4	0·57	8·5...11·0	8·153	7½ m. in L.
603	B.A.C. 3992 ...	11 42 28	14 57	336·2	1·59	7·0...11·0	8·208	
				339·2	1·46	6½ ...11·0	8·211	
604	β Leonis	11 42 56	15 15	345·0	77·14	...13	8·236	Very faint.
				343·3	76·00	...13–14	8·320	Single distance.
605	B.A.C. 4149 ...	12 13 58	−21 30	143·4	1·31	6 ... 8	8·153	
				145·0	1·20	... ...	8·320	
606	Corvi 35	12 19 48	−14 17	95·3	1·32	7 ... 9	8·285	Unsteady.
				100·5	1·43	... ...	8·323	Good. L. 23250.
607	Schj. 4572 ...	12 35 2	− 0 48	312·3	1·07	8·5...11·0	8·151	
				317·1	1·42	... ...	8·244	
				318·2	1·15	... ...	8·255	
				315·5	1·02	... ...	8·277	
608	15 Canes Ven. ...	13 4 11	39 10	283·1	1·27	5½ ...10·5	8·249	A and B.
				286 8	1·17	... ...	8·381	
609	W¹ xiii. 27 ...	13 4 28	− 4 18	356·1	0 89	7 ...11	8·323	Very unequal.
610	Virginis 504 ...	13 17 28	−20 19	18·3	4·02	6·8...10·5	8·244	L. 24812 (6½ m).

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
611	L. 25159 ...	13 31 15	−14 7	258·7	4·88	8·5...12·0	8·353	Found in looking for H. 2666.
				260·1	4·38	... ...	8·359	
612	B.A.C. 4559 ...	13 33 40	11 21	57·2	0·3 ±	6 ... 6	8·244	Diffused.
				56·8	0·26	6 ... 6	8·323	First class measure.
				54·4	0·19	... ...	8·438	Very good.
613	Arg. (35°) 2494 ...	13 46 3	35 16	146·2	0·78	9·0... 9·0	8·422	
614	OΣ 271 *rej.* ...	13 48 1	10 44	270·2	0·59	8 ...12·0	8·323	
				266·5	0·60	8 ...11·5	8·438	
615	O.² Arg. 14509 ...	14 17 52	49 4	237·1	2·35	8·5... 9·5	8·296	
616	γ Boötis	14 27 15	38 50	98·8	26·20	... ...	8·249	About 12–13 m.
				98·4	26·17	... ...	8·252	
617	S. 663	14 42 23	−23 45	219·5	59·72	6½ ... 8	8·323	A and B.
				219·6	59·16	... 9	8·362	
				337·4	2·88	...11·5	8·323	B and C.
				335·9	2·59	... ...	8·362	
618	α¹ Libræ	15 5 23	−19 20	110·7	57·41	... ...	8·320	A and B.
				110·3	57·68	... ...	8 323	
				110·5	57·29	... ...	8·359	
				25·7	...	10 ...10	8·320	B and C.
				24·3	1·99	... ...	8·323	
				22·6	1·98	... ...	8·362	
				24·6	1.62	... ...	8·383	
619	Serpentis 55 ...	15 37 34	14 3	356·6	0·42	6½ ... 7	8·246	L. 28666.
				362·8	0·73	... ...	8·452	Very unsteady.
620	H. 4803	15 38 54	−27 41	166·8	0·86	7·5... 7·5	8·383	A and B.
				214·1	50·25	9·0	8·383	AB and C.
621	W² xv. 1130 ...	15 45 54	45 7	75·1	0 5 ±	7·5... 8·0	8·476	Very poor.
622	π Scorpii... ...	15 51 36	−25 46	133·2	49·82	6 ...12	8·383	
				132·1	50·16	... ...	8·419	
623	L. 29127... ...	15 54 51	− 6 38	238·4	0·97	8·0... 9·0	8·452	
624	O¹. Arg. 15565 ...	16 15 41	−22 50	323·0	1·21	8·0... 9·5	8·438	Near 5 Ophiuchi.
				320·4	1·03	8·0...10·0	8·507	
625	ω Herculis ...	16 19 52	14 19	173·5	2·16	'5 ...12	8·540	
				175·9	...	... ...	8·610	Too poor for distance.
				176·6	1·71	11·8	8·627	
				103·3	33·60	11·5	8·540	A and C.
				103·0	34·00	... ...	8·627	
626	φ Ophiuchi ...	16 24 16	−16 21	35·8	32·83	4 ...12–13	8·323	
				36·0	32·10	... ...	8·507	
627	52 Herculis ...	16 45 43	46 12	309·3	2·02	5 ...10	8·299	
				309·5	1·67	... ...	8·337	

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
				308·0	2·02	11	8·395	
				310·3	1·64	... ...	8·408	
				309·8	1·79	... ...	8·476	
628	W² xvii. 359 ...	17 13 55	32 47	5·6	0·54	9·0 ... 9·5	8·411	
629	Arg. (32°) 2883 ...	17 14 7	32 11	349·8	0·96	8·2 ... 9·0	8·395	
				341·9	1·03	8·5 ... 9·0	8·414	
630	Arg. (32°) 2891 ...	17 15 53	32 25	225·2	1·60	8·5 ...11·0	8·395	
				225·7	1·72	9·0 ...10·5	8·414	
631	Ophiuchi 255 ...	17 33 47	− 0 35	69·7	0·35	7·0 ... 7·0	8·512	Well separated.
				70·7	0·38	7·0 ... 7·0	8·622	Separated.
632	O⁂ 336 *rej.* ...	17 43 32	34 19	344·9	5·7	12–13	7·504	AB.
				342·3	5·46	... ...	8·441	
				165·0	...	6·3 ...10·3	7·504	AC = o⁂ 336.
				164·8	42·80	... ...	8·441	
633	γ Draconis ...	17 53 49	51 30	152·3	20·69	B = 13 m.	8·381	A and B.
				152·0	21·07	... ...	8·395	
				227·1	47·89	12–13	8·381	A and C.
				13·7	56·68	12–13	8·381	A and D.
634	67 Ophiuchi ...	17 54 38	2 56	179·8	45·94	B = 12	8·573	A and B.
				143·0	54·70	5·6 ... 9	8·573	A and C.
				129·2	8·46	C = 13 m.	8·753	C and D.
635	Arg. (1°) 3565 ...	17 56 40	1 35	112·9	1·70	9 ...10	7·509	A and B.
				116·2	1·47	... ...	8·636	
				122·6	68·	... 8·5	7·509	A and C.
636	L. 33280... ...	18 2 4	2 12	127·8	4·92	7 ...12	8·622	
				126·2	4·92	7 ...12·5	8·636	
637	W¹ xviii. 28 ...	18 3 53	3 7	195·2	7·26	6·5 ...12·5	8·636	6 m. in Heis and Arg.
638	⁂ 2287 *rej.* ...	18 4 19	2 34	152·5	...	9·0 ... 9·0	7·509	A and B.
				151·5	22·33	... ...	8·622	
				7·0	...	C = 11·8	7·509	B and C.
				14·8	1·63	... ...	8·622	
				9·7	1·79	... ...	8·626	
639	Sh. 264	18 11 40	− 18 40	147·0	0·76	7 ... 8	8·622	A and B.
				163·6	0·38	7·5 ... 7·5	8·701	
				51·8	17·25	8·0	8.622	AB and C.
				51·6	17·34	... ...	8·701	
640	Herculis 443 ...	18 16 3	27 28	349·5	2·42	7–8...12·0	8·449	L. 33880.
641	L. 33897	18 16 43	21 27	350·9	1·01	7·5 ... 9·0	8·449	
642	Anonymous ...	18 26 50	− 10 29	91·5	4·11	9·0 ...11·0	8·504	
643	⁂ 2342	18 29 41	4 50	337·1	8·69	B = 12–13	7·531	A and B.
				340·1	8·85	... ...	8·515	

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
				337·5	9·04	... ...	8·636	
				7·3	28·90	5·7... 8·5	7·531	A and C. Mags. of Σ.
				8·2	28·70	... ...	8·515	
644	L. 34468	18 30 34	4 51	318·8	17·36	7 ...12	7·531	Near the preceding.
				321·2	17·37	... ...	8·698	
645	Herculis 475 ...	18 38 1	19 21	304·0	9·9	7 ...12	7·534	Distance uncertain.
646	113 Herculis ...	18 49 41	22 30	34·2	35·48	6	8·681	A and B.
				24·9	40·68	... ...	8·681	A and C.
				159·2	7·0	12-13 = 12-13	7·531	B and C.
647	Arg. (13°) 3816 ...	18 50 29	13 27	14·1	1·	9 ... 9	7·520	A and B.
				217·0	20·	9	7·520	A and C.
648	B.A.C. 6480 ...	18 52 30	32 45	309·7	0·59	6·0... 9·0	8·460	
				315·4	0·62	6·0...10·0	8·473	
649	Arg. (32°) 3285 ...	18 54 24	32 19	12·5	1·63	8·5...11·5	8·460	
				13·2	1·51	8·5...11·8	8·473	
650	L. 36918	19 25 6	6 8	142·0	7·4	8	7·520	A and B.
				332·6	10· ±	... ...	7·520	A and C. Faint stars.
				252·8	25· ±	... ...	7·520	A and D.
651	Arg. (27°) 3409 ...	19 25 44	28 2	289·0	6·4	8·5...12·5	7·529	
				291·5	6·36	... ...	8·473	
652	Σ 2539	19 27 16	28 1	334·0	...	B = 13	7·529	A and B.
				328·8	4·78	... ...	8·473	
				3·0	5·8	7·9... 9·7	7·529	A and C = Σ 2539.
				4·5	5·60	... ...	8·473	
				247·1	...	... ...	7·529	B and C.
653	μ Aquilæ ...	19 28 13	7 8	285·5	21·21	... ...	8·622	A and B.
				285·9	21·16	... ...	8·627	
				277·6	...	... ...	7·509	A and C.
				272·3	21·42	... ...	1·627	
				194·4	5·2 ±	13 = 13	7·509	B and C.
654	52, (h^1) Sagittarii	19 29 24	−25 10	162·5	2·87	5 ...11·0	8·515	
				162·3	3·21	10·5	8·698	
				157·5	2·72	11·0	8·701	
655	Σ 2549	19 29 49	63 4	276·7	49·79	7·7... 7·7	8·476	A and B.
				289·4	22·86	... ...	8·476	A and C.
				85·9	27·63	C = 8·9	8·476	B and C.
				152·6	1·93	D = 12-13	8·476	B and D.
656	L. 37475	19 35 47	51 32	262·7	0·4	... ...	7·570	
				254·0	0·56	8·0... 9·0	8·408	
				258·0	0·55	8·0... 9·3	8·534	
657	W^2 xix. 1209 ...	19 38 51	22 21	146·3	1· ±	9 ...10	7·520	
				142·5	0·90	9·5...11·5	8·777	

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
658	B.A.C. 6762 ...	19 39 1	26 50	295·2	0·57	6·5...10	8·529	Near Oϒ 382.
659	Ru. 7844	19 48 48	6 50	318·7	12·3	... ...	7·509	
				316·0	12·32	6½ ...12·5	8·625	
660	B.A.C. 6963 ...	20 9 40	43 1	318·1	9·44	7 ...13–14	8·647	Heis 6–7 m.
661	Cygni 166 ...	20 12 39	40 0	67·5	12·85	6·5...12–13	8·395	B.A.C. 6986
				66·5	12·36	6 ...12·5	8·647	Large star reddish
662	Anonymous ...	20 14 1	−19 59	300· ±	1·7 ±	9 ...10	8·520	
663	L. 39260	20 17 21	53 13	79·4	8·3	6 ...12–13	7·573	Distance uncertain.
664	Aquilæ 264 ...	20 18 36	5 7	285·1	9·66	7 ...12–13	8·622	L. 39236. Very unequal.
665	γ Cygni	20 17 55	39 52	195·8	...	... ...	7·499	A and BC.
				197·2	...	... ...	7·666	
				196·7	140·3	... ...	7·709	
				196·2	140·43	... ...	8·395	
				196·5	140·58	... ...	8·655	
				306·2	...	10 ...11	7·499	B and C.
				304·4	1·39	... ...	8·408	
				304·8	1·42	... ...	8·647	
666	Arg. (53°) 2392 ...	20 19 9	53 15	121·4	1·7	8½ ...11	7·581	
667	L. 39280	20 19 38	7 29	233·2	9·14	7½ ...11	8·468	
				...	...	... ...	8·701	Not seen. Good night.
668	B.A.C. 7080 ...	20 25 49	−10 16	28·5	4·31	6·0...12·0	8·594	
				32·8	4·95	... ...	8·622	
				25·6	4·66	6·5...11·5	8·678	
669	ω^2 Cygni	20 26 20	48 33	342·5	17·26	5½ ...13·5	8·649	A and B.
				86·3	56·28	10·0	8·649	A and C.
670	Arg. (13°) 4435 ...	20 27 16	13 32	55·5	0·74	8·5... 8·8	7·744	
				61·1	0·77	... ...	7·766	
671	O.^{2} Arg. 20741 ...	20 29 34	62 3	334·8	0·5 ±	8·0...10·0	7·573	
672	71 Aquilæ ...	20 32 8	− 1 31	280·6	30·14	12·5	8·622	
				281·1	30·90	12·5	8·698	
673	Arg. (20°) 4680 ...	20 36 28	20 18	298·2	...	7·7...	7·573	
				298·0	4·10	7·0...11·8	8·777	
674	Yar. 9020 ...	20 37 53	−21 19	120· ±	1·3 ±	8 ...10·5	7·509	
675	51 Cygni	20 38 31	49 54	102·3	3·	... ...	7·589	A and B.
				98·8	2·78	6 ...12–13	8·476	
				103·3	2·77	13	8·647	
				182·4	25·39	12	8·395	A and C.
				328·4	32·85	12	8·395	A and D.
676	ε Cygni	20 41 20	33 31	323·0	...	B = 12·0	7·504	
				319·7	37·59	... ...	8·305	
				320·0	37·86	... ...	8·436	Mean = 320°·9, 37″·72 (1878·1).

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
677	W² xx. 1372 ...	20 42 23	33 56	300·6	...	7·0...12·0	7·496	
				301·6	10·	... ...	7·583	
				301·6	9·66	... ...	8·408	
678	L. 40636	20 54 20	− 8 49	182·3	2·2	8½ ...	7·526	
				189·5	2·45	8·0...11·5	8·777	
679	Anonymous ...	21 1 25	43 12	71·5	0·3 ±	... ...	7·556	
				64·7	0·38	10 ...10	8·647	
680	Arg. (53°) 2546 ...	21 1 53	53 10	131·4	0·5	8 ... 8+	7·570	Distance uncertain.
681	Ru. 9004	21 7 40	16 27	241·5	2·32	6·5...10·8	8·537	Not in Heis.
				237·8	2·83	7·0...11·5	8·698	
				239·7	2·38	7·5...11·5	8·701	
682	L. 41222	21 8 30	4 12	105·6	5·64	7·5...12·0	7·766	
683	L. 41683	21 20 44	−20 44	198·4	2·04	8½ ...11	7·526	
684	W¹ xxi. 517 ...	21 23 53	− 5 57	133·9	1·11	9·0... 9·2	8·622	In the field with β 72.
685	2 Pegasi	21 24 31	23 7	334·4	29·91	5½ ...13	7·703	
				333·8	29·74	12–13	8·395	
686	OΣ (App.) 220 ...	21 33 44	55 14	117·5	0·4	... ...	7·586	A and B.
				11·1	...	8·0... 8·0	7·586	AB and C.
				11·0	41·67	... ...	8·647	
687	R. 5340	21 34 54	55 15	187·8	0·5 ±	... ...	7·586	Near the last.
				189·1	0·89	8·0... 9·0	8·647	Distance too large.
688	R. 5364	21 37 43	40 30	213·4	0·3	... ...	7·553	
				205·3	0·34	... ...	7·720	
				211·6	0·48	7·5... 7·5	8·408	
				206·5	0·31	7·8... 7·8	8·673	
689	Aquarii 88 ...	21 38 43	2 26	235·2	1·76	7·0...10·5	7·725	L. 42384.
				245·4	1·68	8·0...11·5	8·678	
				243·1	1·95	... ...	8·701	
690	μ Cephei	21 39 50	58 14	260·1	19·06	5 ...12	8·425	A and B.
				259·5	19·49	5 ...12	8·663	
				299·4	41·19	... ...	8·425	A and C.
691	Arg. (17°) 4529 ...	21 40 4	17 12	328·3	1·16	9·0...11·5	7·760	Difficult.
692	L. 42601 ...	21 44 49	31 17	11·2	2·46	7·5...11·0	7·703	A and B.
				10·5	2·51	7·5...11·0	8·780	
				119·2	...	...11	7·703	A and C.
				119·4	36·89	... ...	8·780	
693	L. 42730 ...	21 49 54	− 7 33	50·7	0·97	8·0...10·5	7·772	
				54·6	0·92	7·5...10·0	8·633	
				57·0	0·91	8·0...10·5	8·701	
694	Lacertæ 4 ...	21 57 6	43 54	351·3	0·54	6·0... 8·5	8·660	B.A.C. 7681.
				353·2	0·47	6·0... 8·5	8·673	

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
695	Arg. (60°) 2330 ...	21 58 33	60 31	147·7	2·70	8·0...12–13	8·425	Very unequal.
				147·9	2·38	8·0...12·0	8·668	
696	Arg. (15°) 4557 ...	21 58 44	15 19	351·1	0·82	9·0... 9·5	7·717	Distance too large.
				356·5	0·48	8·0... 8·5	8·701	
697	19 Cephei ...	22 1 27	61 42	95·8	19·75	6 ...12	8·663	
698	L. 43308	22 5 55	6 18	337·4	9·76	7·0...12·0	8·706	
				337·9	10·18	7·5...12·0	8·775	
699	W¹ xxii. 114 ...	22 7 45	7 7	180·6	2·07	8 ...12	7·766	
				189·7	2·11	8·3...12·5	8·775	
				191·6	1·95	8·0...12·0	8·777	
700	Arg. (48°) 3728 ...	22 21 35	49 5	333·1	8· ±	8 ...12	7·583	
				334·6	9·83	8·5...12·0	8·793	Unsteady.
701	L. 43867	22 22 9	11 42	280·9	1·36	7·5...10·5	7·703	
				279·0	1·11	7·5...10·0	8·775	
702	δ Cephei	22 24 43	57 48	286·3	19·17	13	8·649	A and B.
				285·2	19·57	13	8·663	
				191·9	40·88	3·0... 5·3	8·649	A and C.
703	*a* Lacertæ ...	22 26 20	49 40	299·0	30·14	4 ...12	7·581	
				298·6	30·18	12	8·471	
704	Arg. (66°) 1518 ...	22 27 0	66 56	207·3	2·3 ±	9 ...11–12	7·548	
705	L. 44111	22 28 17	40 12	158·0	1·5 ±	7·0...12·5	8·529	Very difficult.
706	Arg. (67°) 1450 ...	22 28 21	67 41	18·1	2·3	8·0...11·8	7·548	A and B.
				253·5	28·5	10·0	7·548	A and C.
707	L. 44138	22 28 46	38 43	46·6	1·86	8·0...12·5	8·476	
708	Arg. (67°) 1451 ...	22 29 32	67 41	288·6	8·	9 ...11–12	7 548	Near No. 706.
709	Anonymous ...	22 35 19	− 3 10	8·5	1·99	8·5.. 10·5	7·807	
				11·1	2·18	... ...	7·947	
				7·0	1·94	8·5... 9·0	8·775	
710	Arg. (28°) 4439 ...	22 36 56	29 5	231·2	0·59	8·5... 8·6	8·657	
711	Lamont 3180 ...	22 39 29	10 34	79·9	0·72	8·5...10·5	8·594	27° *p.* a 7 m. star.
712	Arg. (58°) 2518 ...	22 49 58	58 36	291·6	1·02	9·0... 9·5	7·581	In a small cluster.
713	Σ 2959	22 50 55	− 3 53	102·2	13·65	6·5...10·3	7·804	A and B.
				102·2	13·90	... ...	7·947	
				95·9	8·31	C = 12–13	7·947	B and C.
714	B.A.C. 8084 ...	23 7 57	− 3 17	145·5	0·57	7 ...10	8·636	
715	Aquarii 290 ...	23 8 25	−11 20	255·9	3·07	7 ...12	7·695	L. 45490.
				251·0	3·70	7·5...11·0	7 760	
				257·5	3·53	7 ...11·5	8·610	
				259·1	...	... ...	8·627	Clouded.
				256·3	3·10	6·5...12·0	8·775	
716	Anonymous ...	23 9 15	−9 43	208·4	...	... ...	7·526	
				208·9	1·70	9–10...10–11	7·695	

No.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
717	8 Andromedæ ...	23 12 11	48 22	162·0	7·4	... ...	7·589	
				159·3	7·86	5 ...12–13	8·471	
				162·8	7·58	12·5	8·671	
718	64 Pegasi ...	23 16 3	31 9	87·4	0·47	5½ ... 7½	8·675	
				83·4	...	... ...	8·701	Suddenly diffused.
				89·9	0·45	6 ... 9	8·733	
719	W¹ xxiii. 363 ...	23 19 23	15 2	10·9	1·11	8·0 ...11·0	7·862	
720	72 Pegasi ...	23 28 0	30 40	127·2	0·35	5·8 ... 6·0	8·675	
				124·4	...	... ...	8·720	Clouded.
				129·7	0·41	6 ... 6	8·733	
				130·5	0·43	6 ... 6	8·736	
				127·4	...	... ...	8·755	Clouded.
				127·7	...	... ...	8·769	Poor seeing.
				127·2	0·43	6 ... 6	8·775	
721	W¹ xxiii. 592 ...	23 30 7	− 7 47	136·4	0·4 ±	9 ... 9	7·845	
				140·0	0·51	... ...	8·610	
722	Arg. (41°) 4886...	23 32 33	41 50	348·6	7·45	6·8 ...12·5	8·529	7·0 m. in Arg.
723	L. 46375	23 34 32	− 0 15	168·4	3·60	7·5 ...11·0	7·780	
				170·6	4·32	... ...	7·876	
				167·1	3·76	7·0 ...11·0	8·622	
				167·8	3·45	7·0 ...11·8	8·722	
724	W¹ xxiii. 691 ...	23 34 46	7 18	85·7	0·75	9·0 ... 9·5	8·733	
725	L. 46464	23 36 37	−12 0	240·3	4·10	7·0 ...11·0	7·775	
				234·3	4·51	... ...	7·876	
726	Anonymous ...	23 40 ±	−13 25 ±	324·2	0·91	8·5 ...10·5	7·856	
727	W² xxiii. 866 ...	23 41 25	24 55	313·9	8·67	7 ...12–13	8·622	
				313·0	8·80	7 ...12–13	8·769	
728	L. 46752 ...	23 46 5	42 50	173·0	1·24	8·5 ... 8·5	7·785	
				172·3	1·04	8·2 ... 8·2	8·668	
729	O¹ Arg. 23124 ...	23 49 15	−18 26	346·4	11·42	8 ...12	7·703	7 m. in Arg.
730	27 Piscium ...	23 52 32	− 4 13	264·9	1·44	5–6...10·0	7·942	
				265·9	1·52	11·0	8·610	
				266·5	1·29	11·5	8·627	
731	L. 47033	23 53 27	− 8 28	256·3	1·66	9·0 ...10·5	7·856	
				259·4	1·48	8·5 ... 9·0	8·701	
732	W¹ xxiii. 1086 ...	23 54 18	7 50	153·1	6·03	8·5 ...11·0	7·742	
				151·2	6·23	8·5 ...10·0	8·610	
				152·8	6·03	8·5 ...11·0	8·701	
733	85 Pegasi ...	23 55 52	26 27	272·4	0·77	6 ...12·5	8·675	A and B.
				271·5	0·59	12·0	8·733	
				278·0	0·66	13	8·775	

No.	Star Catalogue.	R.A. 1880.	Decl. 1850.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
		h m s	° ′	°	″			
				33·9	14·06	6.....9	8·395	A and C.
				33·8	14·38	... ...	8·471	
				33·1	14·52	... ...	8·625	
				33·9	14·64	... ...	8·675	
					New Nebulæ.			
...	... ...	3 28 51	−10 16	62·1	206·7	... ...	7·997	
..	... ...	13 3 21	−15 53	90·6	131·6	... ...	8·236	

Notes to the Catalogue of New Double Stars.

No. 485.

A very difficult pair near *β Cassiopeiæ*. The duplicity of this star was suspected at the time of finding *β* 253 with the 9·4-inch of the Dartmouth College Observatory. De. finds the distance of the latter less than 0″·4. This is closer, and probably under 0″·3. As stated in the note to 253, it is one of a small triangle of stars between that pair and *β Cassiopeiæ*.

No. 486. *Ceti* 33.

This is a naked-eye star, 6 m. in Argelander and Heis. It is L. 158.

No. 487. (A and B = Σ 17.)

The new star is very minute. No other measures of the wide pair since 1830.

Σ	P = 29°·3	D = 26″·33	1830·0
β	28·9	27·06	1878·2.

The two measures of BC give,

P = 265°·4	D = 2″·04	1878·2.

No. 491. *δ Andromedæ*.

The small attendant was seen with the Washington 26-inch in 1875, but no record made of it at the time, and subsequently I was not quite certain of the identity of the star. The three measures give:—

P = 299°·3	D = 27″·86	1878·4.

No. 492. B.A.C. 201.

This very unequal pair was found on the occasion referred to in the note to the preceding pair. Not included in my former lists, and no other measures.

No. 493.

The preceding of a small triangle of 9 m. stars, $2^m\ 59^s$ *p.* ν *Cassiopeiæ*, and $8'{\cdot}7$ *n.*

No. 497. B.A.C. 239.

A naked-eye star, with a difficult double companion. B is Arg. (50°) 137.

No. 506. η *Piscium.*

A very fine, but excessively difficult pair. There is no known pair among stars of this magnitude, or brighter, with so close and minute a companion. I found the highest power necessary to show it satisfactorily, and all the measures were made with that eye-piece. The small star appeared decidedly blue. The following is the mean result of the three measures:—

	P = 12°·9	D = 1″·02	1878·7.

No. 509.

In a low-power field with Σ 155, $28^s{\cdot}9$ *p.* and $5'{\cdot}6$ *n.*

No. 510. (A and C = ♅ V. 92.)

The principal star is Rümker 430. The new star is very minute. On one or two nights later I could not see it well enough to measure. I find no other measures of the wide pair in the present century. Some change is probable.

♅	P = 322°·7	D = 51″·27	1783·0
β	326·4	53·56	1878·1.

No. 511. (A and B = Σ 171.)

The new star is very faint. Relative motion in the wide pair is clearly shown. The following are all the measures to this time:—

Σ	P = 157°·6	D = 27″·89	1829·9
DE.	159°·0	29″·12	1865·1
β	159°·8	29″·69	1878·2.

The three observations of BC give:—

P = 316°·0	D = 3″·69	1878·2.

No. 512.

This unequal and difficult pair is in the field with the well-known double, γ *Arietis*, and was connected with that star by SOUTH and HERSCHEL.

SH.	P = 85°·2	D = 228″·76	1823·9
β	84°·6	223″·3	1877·9 single distance.

There is a very minute star about midway between this and γ *Arietis*. This double companion is similar to that of *Regulus*, but closer and rather more difficult. The first measure is uncertain in distance.

No. 513. 48 *Cassiopeiæ*.

An extremely easy pair for a naked-eye star. It is a little strange that it has not been detected before, as a very small aperture will show it. It has been measured once by DE., whose measure, and a mean of my two observations, are as follows:—

β	P = 264°·4	D = 1″·04	1878·7	
DE.	265°·1	1″·05	1878·7	Mags. 5·0 .. 7·0.

The third star, C, is excessively faint. A larger star, 82° : 45″.

No. 518. *Ceti* 389.

Heis gives this as a naked-eye star, 6–7 m. In the B.A.C. it is 7 m. A mean of the three measures gives:—

$$P = 138°.4 \qquad D = 1''.57 \qquad 1878.0.$$

No. 521. *Persei* 67.

Heis gives this as a naked-eye star, 6–7 m. A fine, and not very difficult pair. The following is a mean of my measures:—

$$P = 153°.7 \qquad D = 5''.86 \qquad 1878.6.$$

No. 524. 20 *Persei*. (A and C = Σ 318.)

The principal star of this well-known pair is a very close and difficult pair. My first angle differs widely from the three later measures, but as the elongation was not quite certain, there may not be any change in the interval. A mean of the three measures gives:—

$$P = 158°.7 \qquad D = 0''.34 \qquad 1878.7.$$

This distance is certainly too large. I do not think it can exceed 0″·25, and it is probably less than that, as it was not separated fairly on any occasion

Struve's companion seems relatively fixed.

Ḥ	P = 239°.5	D = 14″.03	1783.5
Σ	236°.8	14″.08	1829.1
OΣ	238°.2	13″.99	1851.8
β	236°.1	14″.04	1878.1.

No. 525. B.A.C. 920.

Discovered at Washington with the 26-inch in 1875. It was subsequently seen very well with the 6-inch. It is 16′ *s.* of the well-known binary, ϵ *Arietis*. Not very difficult as the stars are of the same magnitude.

No. 526. *β Persei.*

The celebrated variable star, *Algol.* Sm. noted the largest of the companions measured. The others have not been observed before.

No. 530. *Arietis* 161; Σ 366 *rej.*

The duplicity of the companion was suspected by Σ, but finally rejected in *Mensuræ Micrometricæ.* It is described in the early Catalogue, "Class IV. et I. (7), (9), (9). De Classe I. est dubium." It has never been measured before.

No. 535. ο, 38 *Persei.*

A difficult and rather unequal pair. Magnitude of B somewhat uncertain. It has been measured once by De. This observation, and a mean of my measures stand as follows:—

De.	P = 60°·5	D = 0″·96	1877·8
β	56·8	0·83	1878·2.

Most observers will require a larger aperture to deal with this pair. It is difficult with the large instrument, except under very favourable conditions.

No. 536. (*Pleiades.*) AC = S. 437.

A very close and difficult pair in the *Pleiades*, $1^m\ 13^s{\cdot}2$ *p. Alcyone*, and 4′ 52″ *n.* A mean of the three measures of the close pair gives:—

P = 336°·4	D = 0″·44	1878·7.

The only measures of the wide pair (S. 437) are:—

S.	P = 299°·7	D = 34″·57	1824·0
β	302·4	36·72	1878·7.

The fourth star, D, is faint, and not heretofore observed.

No. 537. (*Pleiades.*)

One of the outer stars of the *Pleiades*, and a very difficult pair from the great difference in the magnitudes. It has been observed twice by De., and the two sets of measures are as follows :—

	°	″	
De.	P = 194·4	D = 0·4±	1877·8
β	185·9	0·60	1877·9.

The difficulty of the object will account for the difference in the measures of the angles. De. calls the magnitudes 8·0 and 10·0. My distances are probably too large.

No. 538. (*Pleiades.*)

Another pair in the *Pleiades*, but very small stars. Place from the Washington Catalogue, where it is 30ˢ·4 *f. Alcyone*, and 20″·5 *s.*

No. 542.

This star is not in any Star Catalogue I have. Place with the micrometer from W[1] iii. 1001.

No. 545. L. 7556.

A difficult pair in the field with OΣ 531, 8ˢ·1 *p.* and 3′ 54″ *s.* The mean of the four measures is :—

°	″	
P = 310·0	D = 1·02	1878·2.

The components are very unequal.

No. 547. 47 *Tauri.*

An elegant pair, and in distance and magnitudes not unlike 38 *Persei.* It has been measured on three nights by De., and the observations are too important not to be given in detail.

°	″	
P = 357·1	D = 0·89	1877·74
361·8	0·85	1877·83
360·3	0·73	1878·13.

Most observers, and certainly those less experienced, will find it too difficult for an aperture of only $7\frac{1}{2}$ inches. The mean of the two sets of measures is as follows:—

	°	″		
β	P = 359·7	D = 0·89	1877·8	Mags. 5 . . 8
DE.	359·7	0·82	1877·9	5 . . 7·5

The third star, C, is very faint.

No. 550. *Aldebaran.* (A and C = ℍ VI. 66 = S. 452 = Σ 2 App. II.)

The new companion, much nearer than the well-known attendant of ℍ and Σ, is very minute, and not unlike in appearance and difficulty HALL'S outer satellite of *Mars*. The colour and magnitude of the large star make the comparison more striking. I saw the companion very fairly with the aperture contracted to 12 inches. It has been measured on three nights by HL. with the 26-inch. The following are the mean results:—

	°	″	
β	P = 109·0	D = 30·45	1877·9
HL.	110·5	31·26	1878·0.

The change in the direction and distance of the old companion is due to the proper motion of the large star, as will be seen from the following:—

	°	″	
ℍ	P = 37·0	D = 87·75	1782·0
Σ	36·0	109·08	1836·0
DE.	34·9	112·66	1863·4
β	35·2	113·94	1877·9.

No. 551. 96 *Tauri.* (A and B = H. 3261.)

H.'s companion has a minute attendant about the same distance from A. The description in H. of A and B is:—

	°	″	
	P = 55·8	D = 25±	Mags. 6 . . 13

The third star appears to have about one-half the light of B.

No. 554. *ε Aurigæ.*

The distance in the second measure of B came out 49″·93, in which, as shown by later measures, there is some error in reading. The third star very faint. Subsequently a nearer star was detected, 224°·5 : 29″·31 (1878·9.)

No. 555. *β Orionis.* (A and B = ♅ II. 33 = Sh. 53 = Σ 668.)

An elongation in the 9 m. companion of Σ and ♅ was suspected as long ago as 1871 with the 6-inch refractor, and the attention of observers called to it in a communication in the *English Mechanic.* The star was examined subsequently a great many times with the same aperture, and although there was always a peculiar appearance about the vertical diameter, I could not fully satisfy myself that it was really double. In 1876 I learned from Mr. Herbert Sadler that he had suspected the companion to be double independently, and I again tried it under the most favourable circumstances with the 6-inch, and with about the same result as before, but the appearance of the star was always such as to encourage further attempts. The attention of other observers at various points, with larger apertures, was solicited, but the results so far as they reached me were either negative or unfavourable to the suspected double nature of the small star. As early as practicable in 1877 the 18½-inch was directed to the solution of the difficulty, and the star examined on a great many nights, only three of which were sufficiently perfect in definition for micrometrical measures. The highest power only gave a small elongation, but that appeared to be well defined and certain, and I have no doubt now of the duplicity of this star. I have spent more time in observing this star by way of getting at this result than any other star in the heavens, although some of the pairs in my Catalogues have required attention for a year or more before their true character could be positively ascertained. In regard to the measures of distance, it should be stated that they more properly represent the longer diameter of the star. The true central distance is certainly less than 0″·2. It is the closest, and perhaps most difficult, pair of this class I have ever seen. I hope during the coming season to obtain a better series of measures (*Monthly Notices*, June 1878).

The faint and distant star, C, was detected by MITCHEL, but has never before been measured. He called it 15 m. He gives a diagram of the three stars in the *Sidereal Messenger* for May 1846. It is apparently unchanged.

In the *Radcliffe Observations* (vol. xxii.) a 9–10 m. star is measured from *Rigel* as follows:—

$$P = 243^\circ 3 \qquad D = 37''.12.$$

This is certainly a mistake. There is no star of any magnitude in this place. The observation probably belongs to some other portion of the heavens.

No. 556. L. 10159.

A fine unequal pair near η *Orionis*, *sf.* There is something strange about the absence of this star from most of the Star Catalogues. It is not in BODE, B.A.C., SCHJ., WEISSE, YARNALL, RÜMKER, or LAMONT. The only Catalogue I have been able to find it in is LALANDE, where it is rated 8 m. It appeared to me much brighter, and was noted 6½ m. It may prove to be variable. On one or two nights subsequently the small star was seen, but was not measurable.

No. 557. (A and B = Σ 721 = ♅ IV. 45 = SH. 57.)

The small star of this wide pair found to be a very close and exceedingly difficult pair. Excellent conditions are necessary to observe it with any aperture. There is no evidence of change in the distant stars:—

Σ	P = 150°8	D = 24″21	1830·2
EN.	151·2	23·99	1863·1
β	149·8	24·32	1878·1.

No. 558. δ *Orionis*. (A and C = Σ 14 App. I = ♅ V. 10.)

An excessively faint companion nearer than that previously known; perhaps the faintest of any of the minute attendants to large stars noted in this Catalogue. The mean result of the measures is as follows:—

$$P = 227^\circ 0 \qquad D = 33''.79 \qquad 1878.9.$$

There is no change in the wide pair since the first observations:—

		°	″	
Σ	P =	359·2	52·74	1835·7
β		359·5	52·80	1878·0.

No. 559.

The wide pair, AC, was noted by H. and SM. It is in the nebula 78 M, very near the Equator, in *Orion*. The only measures are by SM., 32°·0 : 45″·0 (1836·8), but his observations of stars of this class are so uncertain that the evidence of change is too slight to be regarded.

No. 561. L. 10969.

Observed at first for H. 5465, one of H.'s suspected pairs. Subsequently the latter (L. 10989) was examined, but no trace of the suspected 12″ companion.

No. 562. L. 11127.

Near θ *Aurigæ*. Not much doubt of the duplicity of this star, but difficult and not well seen. In L. 7 m., and 7·3 in ARG. (*See Note on last page.*)

No. 566. *Monocerotis* 21.

In LALANDE 6 m. and BODE 7 m. My estimate perhaps too low.

No. 567. *Monocerotis* 23.

Near the ast. In LALANDE 6 m, BODE 7 m., and SCHJ. 8 m.

No. 568. *Canis Majoris* 33.

Estimated distance 1″; the measured distance may be too large.

No. 570. 11 *Monocerotis*.

A fourth star added to the well-known triple, Σ 919. Mean of three measures:—

	°	″	
P =	56·1	D = 25·79	1878·0.

No. 573. L. 13642.

In L., 6½ m., but not in the other Star Catalogues. I failed to make any measures of this, but it has been observed by others as follows:—

	°	″	
De.	P = 246·9	D = 0·81	1878·2
O. S.	244·9	0·8±	1878·2.

No. 575. *Canis Majoris* 156. (A and C = Σ 1057.)

The large star of Σ 1057 found to be double. Magnitude of C from Σ. The following are all the measures of the wide pair:—

	°	″	
Σ	P = 1·9	D = 15·28	1831·2
β	2·1	15·87	1878·1.

No. 579. OΣ 173 *rej.*

A and C, with another more distant star, make OΣ 173. It was rejected in the revised edition of 1850 of the Pulkowa Catalogue, as it exceeded in distance the limit adopted of 16″. In April 1875, when examining this pair with the 6-inch, I suspected the principal star was double, but failed to verify it later. The measure of C is by single distances and probably too small :—

	°	″		
De.	P = 233·6	D = 18·24	1869·7	AC
	347·3	43·12	1867·9	AD.

It is 1° 15′ *s.* of *Castor.*

No. 580. *Pollux.*

The three distant stars, C, D, and E, have long been known (= Σ 5 App. II. = ♆ VI. 42 = S. 559). The nearest of these was found to be a moderately close and very unequal pair, and is one of the most difficult objects of that class in this list. It was better seen during the second measure. No small aperture will be able to deal with it satisfactorily. The small star, B, is much nearer the principal star than any hitherto

measured. Only single distances of this and first measure of C. The larger of the three distant stars, E, has been measured as follows:—

Σ	P = 73°·9	D = 203″·84	1836·3
Dʙ.	74·9	222·21	1865·3
Flm.	75·2	228·9	1877·1.

For C we have:—

♅	P = 65°·9	D = 116″·7	1781·9
S.	66·4	132·3	1825·1
Flm.	72·1	175·0	1877·1.

The change is due to the proper motion of the large star.

No. 582. (A and B = Σ 1179.)

The wide pair is Σ 1179, to which a minute companion, C, is added. The distance of AB is increasing.

Σ	P = 205°·2	D = 17″·91	1829·7
Dʙ.	204·6	19·13	1864·3
β	204·5	19·75	1878·1.

No. 583. L. 15959.

Found in looking for the missing pair, ♅ II. 87, the place of which, according to ♅, is 5^m 18^s *f.* this, with same declination. ♅ gives only an angle of 176°·2; so the two cannot be identical unless there is considerable motion in angle. It is too close now for his Class II. This pair has been measured at Cincinnati and Gallarate as follows:—

O.S.	P = 68°·4	D = 1″·75	Mags. 9·0 . . 9·8	1878·16
Dʙ.	67·5	1·71	9·5 . . 10·0	1878·26.

No. 584. P. VIII. 124. (ACD = S. 571.)

This is the principal star of the wide triple in *Præsepe*, SOUTH 571. These stars are relatively fixed.

		°	″	
A and C	S.	P = 157·0	D = 45·03	1825·1
	DE.	156·8	44·97	1874·0
A and D	S.	241·0	92·25	1825·1
	DE.	241·9	92·71	1874·0.

DE. gives the magnitudes of the large stars, 7·0, 7·2, and 6·50 respectively.

No. 585. *Cancri* 109 (= B.A.C. 2927).

A very close and difficult pair in the outskirts of *Præsepe*. The second measure was made with a power of 925, and the components well seen. In LALANDE this star is 7 m., and 8 m. in B.A.C.

No. 587. 15 *Hydræ*.

This star, with the two distant companions, C and D, is ♅ V. 120. ♅ gives 340° ± : 43″·03 (1783·0) for the nearer. There are no other careful measures. SMYTH calls the magnitudes 12 and 13 respectively. The close pair is an exceedingly difficult object. Observed twice at Cincinnati as follows:—

	°	″	
O.S.	P = 163·5	D = 0·25	1878·16
	165·1	0·46	1878·22.

No. 594. *Leonis* 150.

This is L. 20111 (7 m.). Measured by DE. as follows:—

	°	″		
DE.	P = 141·8	D = 1·55	1878·33	Mags. 6·5 . . 11·0.

No. 595.

About 15′ *n.* of Σ 1474. Not in any Star Catalogue I have.

No. 599. p^3, 65, *Leonis*.

A fine and only moderately difficult pair. The mean result is:—

	°	″	
β	P = 82·4	D = 1·78	1878·2.

No. 600. *Crateris* 36. (And C = ♅ N. 26 = Sh. 120.)

The principal star of this wide pair has an extremely minute companion. Not seen well enough to measure on any subsequent occasion. It is certainly smaller than 12 m. With very good definition on April 29, I could not be sure of it. There appears to be some change in the distant star. The following are all the measures:—

	°	″	
Sh.	P = 97·6	D = 67·06	1823·4
β	97·3	61·53	1878·1.

Heis gives this as a naked-eye star, 6–7 m.

No. 601. (A and B = ♅ IV. 112 = S. 627.)

The smaller star of this wide pair is double; not very difficult, but too unsteady for measurement on the other nights. It is difficult to reconcile the measures of distance of the wide pair. The following are all the recorded measures:—

	°	″	
♅	P = 148·7	D = 26·25	1783·0
S.	330·7	29·96	1825·2
β	331·6	28·16	1878·3.

No. 603. *Leonis* 472.

A large star *sp.* β *Leonis*. Kn. gives the angle and distance from β *Leonis*,

	°	″	
Kn.	P = 201·5	D = 1134·3	1864·4.

In B.A.C., 6½ m., but not a naked-eye star according to Heis. A fine, and not difficult pair.

No. 605. *Corvi* 26 (= B.A.C. 4149).

A comparatively easy pair near *ζ Corvi*. In B.A.C., 6½ m., and 6 m. in LALANDE, but not in HEIS.

O.S.	P = 137°·4	D = 0″·99	1878·22 Mags. 6·0 . . 8·2.

No. 607. SCHJELLERUP 4572.

A pretty little pair in a low-power field with *γ Virginis*, 37^s almost exactly *p*. In ARG., 9·2 m. The mean result is :—

β	P = 315°·8	D = 1″·16	1878·2.

No. 608. 15 *Canes Ven.*

15 and 17 *Canes* make the wide pair, Σ 24 App. I. This appears to be relatively fixed, or but little changed.

Σ	P = 297°·5	D = 289″·98	1835·7
DE.	297·3	288·30	1865·2.

The new companion is not at all difficult. The two measures give:—

P = 284°·9	D = 1″·22	1878·3.

No. 612. B.A.C. 4559.

A very difficult close pair. Stars just in contact with eye-piece IV. Professor HALL has measured this on two nights with the Washington 26-inch. The mean results are:—

HL.	P = 57°·7	D = 0″·28	1878·43
β	56·1	0·23	1878·33.

A few minutes after making the third measure, Σ 1879 was observed, and that pair was certainly double the distance of this. ARGELANDER and HEIS give this 5 m.

No. 613.

The *p.* star of a wide pair (84°·3 : 49″·1) 12ˢ·4 *f.* the 6 m. star B.A.C. 4628.

No. 614. OΣ 271 *rej.*

This star was marked "oblonga?" in the first edition of the Pulkowa Catalogue, but rejected as single in the revised edition of 1850. The only measures or attempted measures are the following by Ma.:—

	°	″	
P =	144·2	D = 0·2	1843·3
	130·2	0·22	1849·7.

In April 1876, I examined it with the 6-inch and suspected an elongation in the direction of 150°. The large instrument brought out an excessively difficult companion, which probably has nothing to do with the preceding observations. With a power of 925, which widely separated the components, the larger was perfectly round. It is L. 25572, and the south star of three in a low-power field. (*Astr. Nach.* 2199.)

No. 617.

The wide pair is S. 663, and also ♅ VI. 117, but there is an error of −16′ in the declination of ♅. The following are all the measures of A and B.:—

	°	″	
S.	P = 219·1	D = 56·69	1825·3
β	219·5	59·44	1878·3.

The principal star is L. 26952.

No. 618. ι^1 *Libræ.*

The wide pair is ♅ VI. 44 and Sh. 376. The small star is itself double, somewhat resembling μ^2 *Herculis*. There seems to be change in the distance from the primary, but the measures are conflicting:—

	°	″	
♅	P = 112·5	D = 59·07	1782·3
Sh.	111·6	50·63	1822·8
β	110·5	57·46	1878·3.

Should distance of Sh. be 58″·63?

A mean of my measures of B and C gives:—

β	P = 24°·3	D = 1″·86	1878·3.

No. 619. *Serpentis* 55.

A fine close pair. My second distance is certainly too large. The real distance is probably less than 0″·4.

No. 620. (A and C = H. 4803.)

The description in H of the wide pair is:—

H.	P = 214°·8	D = 40″·±	1836·7	Mags. 8 . . 9.

The large star is itself double. The direction of C is apparently unchanged.

No. 625. ω *Herculis.*

A pretty pair, and not difficult. The companion was seen at Denver, Colorado, with the 6-inch, which was taken to that point to observe the total eclipse of July 29. The observation was made at an altitude of about 5,200 above the sea, and in a locality remarkable for the purity of its atmosphere.

A mean of the measures gives:—

β	P = 175°·3	D = 1″·90	1878·6.

No. 627. 52 *Herculis.*

A fine, easy pair. The mean of the five measures is:—

β	P = 309°·4	D = 1″·83	1878·4.

No. 628.

A rich neighbourhood for double stars, near 68 *Herculis*. This pair, and the two following (Nos. 629, 630), OΣ 328 and β 45, are all in the same vicinity.

No. 631. *Ophiuchi* 255. L. 32200.

A close equal pair, for which the two measures give:—

β	P = 70°·2	D = 0″·36	1878·5.

No. 632. L. 32600. (A and C = OΣ 336 *rej.*)

A much nearer companion detected than that known heretofore. The following, which are all the measures of the wide pair, seem to show a small diminution in distance:—

Ma.	P = 164°·0	D = 44″·66	1843·3
De.	164·9	43·19	1866·9
β	164·9	42·80	1878·4.

The magnitudes of A and C are from De.

No. 633. γ *Draconis*.

All very faint companions. There are two more distant and larger stars having about the same position angles as C and D. Edgecomb saw B readily with a 9·4-inch Clark refractor without any intimation in regard to the direction.

No. 634. ο, 67, *Ophiuchi*. (AC = ℍ VI. 2 = Sh. 255 = OΣ (App.) 162.)

The nearest star, B, not mentioned by ℍ, is found in the Munich Observations, with measures from C:—

Mu.	P = 265°·1	D = 30″·3	1836·7.

In measuring this a very faint attendant to the old companion was detected. The large stars, AC, are relatively fixed :—

	°	″	
SH.	P = 141·3	D = 55·23	1823·3
DE.	142·8	54·79	1874·0
β	143·0	54·70	1878·6.

No. 638. (A and B = Σ 2287 *rej.*)

The only prior measure of the wide pair is found in the Washington Observations for 1862 :—

	°	″	
HL.	P = 150·8	D = 22·22	1863·6
β	152·0	22·33	1878·0.

The close star is small and difficult.

No. 639. L. 33642. (A and C = SH. 264; C and D = β 300.)

In 1874 I found a very minute star near C, estimated 330° : 4″. Looking for this on the present occasion, I noticed the larger star of the wide pair was a close double. The images were very unsteady and the measures are very discordant. The first distance is certainly too large. I could not see D. There appears to be some change in the distance of the wide pair :—

	°	″	
SH.	P = 52·6	D = 16·42	1823·5
HL.	51·5	16·83	1863·7
O.S.	52·4	17·49	1876·6
β	51·7	17·30	1878·6.

No. 642.

The principal star of the cluster, H.G.C. 4420. The larger is decidedly reddish.

No. 643. *Tauri Pon.* 55. (A and C = Σ 2342.)

A much nearer star than that measured by Σ, and rather difficult. By three measures we have :—

	°	″	
β	P = 338·2	D = 8·86	1878·2.

A slow, apparently rectilinear, movement in B:—

Σ	P = 11·9	D = 26·91	1830·7
De.	9·3	28·13	1865·1
Gl.	9·3	28·62	1874·8
β	7·8	28·80	1878·0.

No. 647.

The distances, in consequence of the condition of the micrometer at the commencement of my work, are only approximate. I have been favoured with two measures by De, and the following is the mean:—

A and B	P = 11·5	D = 1·01	1877·7
A and C	215·8	19·56	1877·7.

No. 648. B.A.C. 6480.

This fine pair is a naked-eye star very near *γ Lyræ*, 6 m. in Heis. The difference in the magnitudes of the components, and their distance, make it a difficult pair. The mean of the two observations is:—

β	P = 312·5	D = 0·61	1878·5.

No. 649.

This pair of small stars is 13′ *s.* of *γ Lyræ*. The measures give:—

β	P = 12·8	D = 1·57	1878·5.

No. 651.

An unequal pair 19′·5 *n.* of *β Cygni*.

No. 652. (A and C = ♄ II. 99 = S. 718 = Σ 2539.)

An excessively minute star, a little nearer than the old companion. The measures were made with some difficulty. A and C are relatively fixed.

No. 653. μ *Aquilæ.*

Two very faint companions forming a pair. The distance of BC is uncertain for the reasons already given.

No. 654. h^3, 52 *Sagittarii.*

But for its southern declination this would be a very easy pair. The three measures give:—

β	P = 160°8	D = 2″93	1878·6.

No. 655. (ABC = Σ 2549.)

The new star makes, with one of Σ's companions, a difficult pair. The relations of the large stars have changed considerably. The following are all the measures:—

AB	Σ	P = 278°8	D = 47″48	1832·2
	De.	277·1	49·07	1863·5
	β	276·7	49·79	1878·5.
AC	Σ	291·3	21·12	1832·2
	De.	289·5	22·38	1863·5
	β	289·4	22·86	1878·5.
BC	Σ	89·0	26·88	1832·2
	De.	87·1	27·48	1863·5
	β	85·9	27·63	1878·5.

No. 656. L. 37475.

This close pair has been measured once by De., and the observation, with a mean of my measures, is as follows:—

De.	P = 261°0	D = 0″48	1877·8
β	257·6	0·50	1878·2.

No. 665. *γ Cygni.*

A very distant double companion. The results are:—

A and BC	P = 196°·5	D = 140″·44	1878·0
B and C	305°·1	1″·41	1878·5.

No. 666.

Measure of distance doubtful. It has been observed by De. as follows:—

De.	P = 124°·7	D = 2″·00	1877·8	Mags. 9·0 . . 12·0.

No. 668. B.A.C. 7080.

A naked-eye star, 6 m. in Heis. The mean result of the three measures is:—

β	P = 29°·0	D = 4″·64	1878·6.

No. 669. *ω² Cygni.*

The nearest companion is very faint.

No. 670.

About 50ˢ *p.* this is H. 1527, a 3″ pair of 10 m. stars. The new double is the southern star of a wide pair. It has been measured once by De.:—

β	P = 58°·3	D = 0″·76	1877·75
De.	53°·5	0″·63	1877·83.

No. 671.

This is the *sp.* of two similar stars. It has been measured by De., and the two observations stand:—

β	P = 334°·8	D = 0″·5±	1877·6	
De.	335°·9	0″·47	1877·9	Mags. 8·0 . . 8·5.

No. 673.

The *n.* star of a wide pair. The other is ARG. (20°) 4682, 1″·4 *f.* and 1′·6 *s.*

No. 675. 51 *Cygni.*

The close star, B, is exceedingly minute, and under ordinary circumstances rather difficult. The measures give:—

β	P = 101°·5	D = 2″·78	1878·2.

C and D are brighter, and readily seen.

No. 679.

Without doubt this is the most minute close pair known, and is worth noting as a curiosity in double stars, if for no other reason. It is too small to be found even in ARGELANDER. The place was determined from ARG. (43°) 3802, an 8·8 m. star in a low-power field, *sp.* The magnitude of the double would be perhaps more nearly 11 than 10. It is near *ξ Cygni.*

No. 680.

One of a wide pair of equal stars, the other about 25″ distant in 34°·5. DE. has measured the close pair twice, the mean result of which is:—

DE.	P = 129°·5	D = 0″·63	1877·7.

No. 681. RÜMKER 9004.

The three measures result as follows:—

β	P = 239°·7	D = 2″·51	1878·7.

No. 686. (A and B = OΣ (App.) 220.)

The close pair has been measured twice by DE., from which it would seem my angle is decidely too small, possibly an error of 10°:—

DE.	P = 127°·9	D = 0″·38	1877·7	Mags. 7·7 . . 8·0
β	117°·5	0″·4	1877·6.	

No. 688. R. 5364.

A close pair *sf. 77 Cygni.* The mean of four measures is:—

β	P = 209°·2	D = 0″·38	1878·1.

No. 689. *Aquarii* 88.

The mean of three measures gives:—

β	P = 240°·5	D = 1″·80	1878·0.

No. 690. *μ Cephei.*

The celebrated "garnet star" of H., variable from 4 to 6 m. in five or six years. It is No. 253 of SCHJELLERUP's Catalogue of Red Stars. There is another star in the direction of 190°·8. They are all faint objects. The two measures of AB give:—

β	P = 259°·8	D = 19″·27	1878·5.

No. 693. L. 42730.

For the mean of three observations we have:—

β	P = 54°·1	D = 0″·93	1878·4.

No. 694. *Lacertæ* 4.

A fine close pair, and moderately difficult. The two measures give:—

β	P = 352°·3	D = 0″·50	1878·7.

In B.A.C. 6 m., and ARG. 6·5 m.

No. 696.

The *s.* star of a small triangle. DE. has measured twice, reversing the angle:—

DE.	P = 175°·2	D = 0″·50	1877·8	Mags. 8·0 . . 8·0.
β	353·8	0·65	1878·2.	

No. 699.

In the vicinity of Σ 2878. The three measures give:—

β	P = 187°·3	D = 2″·04	1878·4.

No. 700.

In the field with OΣ (App.) 234, 27^s *p.* and 1′ *s.* De. has the following measure:—

De.	P = 332°·4	D = 10″·33	1878·7.

No. 701. L. 43867.

This difficult pair has been measured twice by De. The mean results are as follows:—

De.	P = 283°·4	D = 1″·24	1877·8	Mags. 7·0 . . 9·0
β	280°·0	1″·24	1878·2	7·5 . . 10·0.

No. 702. δ *Cephei.* (AC = Σ 58 App. I. = ♅ V. 4 = Sh. 347 = OΣ (App.) 235.)

A faint star nearer than the old companion. The measures give:—

β	P = 285°·7	D = 19″·37	1878·6.

The large stars appear to have a common proper motion, as their relations are unchanged.

Σ	P = 192°·0	D = 40″·87	1835·1
β	191·9	40″·88	1878·6.

No. 709.

Near Σ 2938. Not in any Star Catalogue I have, and place found with micrometer from L. 44461. The three measures give:—

β	P = 8°·9	D = 2″·04	1878·2.

No. 710.

A difficult pair of small stars, 30″·3 *s.* of *η Pegasi*, and 26ˢ *f.*

No. 712.

This has been measured once by De.:—

β	P = 291°·6	D = 1″·02	1877·6	Mags. 9·0 . . 9·5
De.	290·4	1·14	1877·7	9·7 . . 10·2

No. 713. (A and B = Σ 2959.)

A very minute star near B. It was missed in the first measure. There is a decided change in the wide pair, as will be seen from the following:—

Σ	P = 96°·7	D = 15″·66	1832·1
Ma.	97·8	14·88	1843·6
De.	101·7	14·21	1864·8
β	102·2	13·77	1878·8.

No. 715. *Aquarii* 290.

This pair has been observed once at Cincinnati. This, and the mean of my four measures are given below:—

O. S.	P = 258°·0	D = 3″·47	1877·8
β	256·0	3·35	1878·3.

No. 716.

A pretty pair of very small stars in the field with ψ^1 *Aquarii* (Σ 12 App. II.), 15ˢ *p.* and 60″ *n.*

No. 717. 8 *Andromedæ.*

The companion is faint, but it is not a difficult object under good conditions. The mean result is:—

β	P = 161°·4	D = 7″·61	1878·2.

No. 718. 64 *Pegasi.*

A fine close pair, and difficult from the considerable inequality in the magnitudes of the stars. It is rather more troublesome to observe than 72 *Pegasi.* The mean of three measures gives :—

β	P = 86°·9	D = 0′·46	1878·7.

No. 720. 72 *Pegasi.*

A close pair of equal stars, discovered a few minutes after the preceding. It is widely separated with the higher powers. The seven measures give as a mean :—

β	P = 127°·7	D = 0″·40	1878·7.

No. 723. L. 46375.

The following is the mean of four observations:—

β	P = 168°·5	D = 3″·78	1878·2.

No. 725. L. 46464.

Measured once by O. S.

β	P = 237°·3	D = 4″·30	1877·8
O. S.	245°·3	4″·46	1877·8.

No. 726.

Not in any Star Catalogue I have. It is about 50′ *s.* of the naked-eye star, B.A.C. 8266.

No. 730. 27 *Piscium.*

This is quite an easy pair. The three measures give :—

β	P = 265°·8	D = 1″·42	1878·4.

No. 732.

The north star of a wide pair:—

β	P = 152°·4	D = 6″·10	1878·3.

No. 733. 85 *Pegasi*.

A very interesting system from the large proper motion and sensible parallax of the principal star. The latter has been investigated by Brunnow (*Dunsink Observations*, 1873) by micrometrical measures of A and C, from which he finds the parallax to be 0″·054. It is not found in any Double Star Catalogue. This is partly accounted for by the fact that at the time of the observations of H. and Σ the distance between A and C was too large to bring them within the limits usually adopted.

Flm. has given this system special attention, and it was at his request that the series of measures here given was commenced. The wide pair was observed three times before the close star was detected, although on each occasion the field was examined with reference to any new member which might exist. These nights, however, were not sufficiently favourable for so difficult an object as the new star. The last night on which C was measured was unusually fine. A short time before on the same evening 64 *Pegasi* and 72 *Pegasi* had been discovered, and a little later η *Piscium* and B.A.C. 1101 were added to this list, all of them being difficult objects of the first class. The small star, B, was then noticed, and an excellent measure obtained. It has been measured since on every available night, but opportunities have been rare when it could be satisfactorily seen. The mean result of the three measures thus far made is:—

β	P = 274°·0	D = 0″·67	1878·7.

It is evident that an examination a few months hence, even without measures, will show at once whether there is any physical connection existing, since the change due to proper motion would otherwise be very apparent in so close a star.

The measures preceding my own of the wide pair are taken from proof

sheets of a most valuable and interesting work by FLM., "Catalogue des Étoiles Doubles et Multiples en mouvement relatif certain," now in the press. The angle and distance by ARGELANDER are deduced from differences of R.A. and Decl.:—

	°	″	
ARG.	P = 105·0	D = 30·0	1855·00
BRUNNOW	77·0	16·00	1870·00
FLM.	49·8	14·0	1877·94
β	33·6	14·40	1878·54.

The minimum distance was reached in 1877, about the time of the observation by FLM., and the stars are now gradually separating. FLM. gives the proper motion of A as follows:—

	s		″
R.A.	+0·064	Decl.	−0·97.

BRUNNOW thinks C has also a small motion in space.

New Nebulæ.

The places given in the Catalogue are those of the stars from which the nebulæ are measured. The first is in the field with a 7 m. star, L. 6634 (6 m. in L.) The other is still nearer the naked-eye star B.A.C. 4396. They are not very faint. The measures indicate the distance and direction from the respective stars. They are not found in HERSCHEL'S General Catalogue, nor in the supplementary Catalogue by Dr. DREYER.

II.—*Micrometrical Measures of* 500 *Double Stars.*

No.	Double Star.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
			h m s	° ′	°	″			
1	Σ 3063 ...	W[1] xxiii. 1234 ...	0 1 28	− 5 13	221·8	1·71	8·3 ...10·2	7·829	
					224·8	1·92	... ...	7·942	
2	H. 1939 ...	... ...	0 3 41	10 45	159·1	36·08	7 ...10	7·807	
3	Hd. 1 ...	W[1] o. 57 ...	0 5 6	7 17	119·6	12·80	7·5 ...17	7·829	Difficult.
4	Σ 14 ...	W[1] o. 134 ...	0 9 42	−12 39	236·2	14·50	8·3 ...11·0	7·942	
					236·4	14·27	... ...	7·953	
5	Σ 15 ...	... ...	0 9 43	− 6 16	197·2	4·61	7·5 ...10·0	7·942	
6	OΣ 4 ...	L. 220	0 10 26	35 49	155·3	0·56	7·5 ... 7·8	8·657	
7	β 392 ...	B.A.C. 46... ...	0 10 31	60 52	69·4	19·43	6·0 ...12·0	8·671	
8	H. 1951 ...	W[1] o. 189 ...	0 12 41	−11 37	216·6	24·09	8–9...15	7·947	H. 215°·4 : 16″ ± .
9	H. 1953 ...	ι Ceti	0 13 19	− 9 30	16·5	61·89	4 ...12	7·942	H. 14°·2 : 45″ ± .
10	Schj. 1 ...	... ...	0 20 45	− 6 11	27·8	25·00	8·7 ... 9·5	7·862	No other measures.
11	Σ 35 ...	... ...	0 25 27	− 2 43	266·6	8·62	9·4 ... 9·6	7·947	
12	De. 2 ...	W[1] o. 459 ...	0 28 22	− 5 12	241·8	0·89	6·9 ... 7·7	7·818	A and B.
13	H. 1993 ...	α Cassiopeiæ ...	0 33 42	55 53	110·7	39·94	... ...	7·573	A and B.
					106·7	40·20	B = 13–14	8·647	
					280·0	62·25	... ...	7·573	A and C.
					279·8	62·51	5–6...14	8·647	
14	Σ 49 ...	... ...	0 34 42	− 7 53	320·8	5·58	6·5 ...10·0	7·862	
					320·8	5·78	... ...	7·876	
15	Σ 18 ...	L. 1118	0 36 11	3 31	116·1	1·39	7·3 ... 9·0	7·947	
16	β 231 ...	ο Cassiopeiæ ...	0 38 2	47 38	303·7	32·16	5½ ...12	8·471	De. 303°·9 : 32″·81 (1876·5).
17	Hd. 8 ...	W[1] o. 715 ...	0 42 28	− 2 25	38·1	6·85	8 ...11	7·876	Mags. 9·0...10·0.
18	Σ 68... ...	... ...	0 45 46	− 8 49	296·0	7·58	8·0 ...10·0	7·876	No change.
19	Σ 67... ...	L. 1432	0 45 52	9 57	10·8	1·52	8·3 ... 9·0	7·953	Probably fixed.
20	Hd. 10 ...	W[1] o. 802 ...	0 47 17	2 39	232·3	1·09	9	7·862	Mags. 9...9+.
21	H. 1057 ...	μ Andromedæ ...	0 50 6	37 51	316·6	36·51	B = 13–14	8·529	A and B.
					314·0	38·05	12	8·742	
					312·6	37·25	13	8·747	
					116·7	39·26	4 ...16	8·529	A and C.
					117·0	38·09	... ...	8·742	
					117·1	37·55	... ...	8·747	
22	Σ 76... ...	... ...	0 50 19	10 1	200·1	2·84	8·8 ...11·5	7·953	
23	H. 1064 ...	39 Andromedæ ...	0 56 10	40 42	0·9	...	6 ...15	8·638	Clouded before distance.
24	β 396 ...	B.A.C. 282 ...	0 56 13	60 26	66·6	1″ ±	6 ...10·5	8·660	Clouded before distance.
					69·1	1·14	6·5 ...11·0	8·796	Unsteady.

No.	Double Star.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
			h m s	° ′	°	″			
25	H. 1068 ...	72 Piscium ...	0 58 44	14 18	263·1	54·81	5–6...18	7·818	
26	O Σ 515 ...	φ Andromedæ ...	1 2 32	46 36	273·0	0·2	5 ... 6·7	7·739	
27	β 235 ...	L. 2042	1 3 27	50 22	76·9	0·84	7·8 ... 7·8	8·647	A and *a*.
					76·6	8·50	9 ...12·0	8·647	B and *b*.
					47·2	8·13	9 ...11·0	8·647	C and *c*.
28	Σ 95... ...	... ...	1 4 24	− 5 36	309·6	14·18	8·5 ... 9·7	7·859	
29	O Σ 28 ...	R. 378	1 8 13	80 16	314·0	0·85	6·8 ... 8·2	8·660	
30	H. 1076 ...	W[1] i. 118 ...	1 9 50	13 6	163·0	14·16	9 ...17	7·859	A and B.
					258·2	41·1	14	7 859	A and C.
31	... ...	Polaris	1 13 45	88 40	...	...	... ...	8·151	
32	H. 637 ...	W[1] i. 237 ...	1 16 28	− 4 26	168·3	25·92	7–8...15	7·845	No measures in H. "very delicate."
33	β 4	W[1] i. 236 ...	1 16 34	10 44	81·0	0·37	7 ... 7·5	7·717	No other measures.
34	H. 1079 ...	44 Ceti	1 18 0	− 8 38	299·6	76·40	6 ...12	7·862	H. 300°·5.
35	O Σ 30 ...	L. 2561	1 18 54	30 55	238·9	4·55	7·3 ...11·7	7·736	B and C.
36	Σ 132 ...	... ...	1 25 35	16 20	354·6	33·86	7·0 ...10·0	8·014	
37	O Σ 32 ...	R. 467	1 30 49	84 37	133·7	8·79	7–8...12	8·660	
					134·2	9·06	... ...	8·668	
38	Σ 145 ...	P. I. 145	1 34 36	25 8	31·9	11·38	6·0 ...10·6	7·725	
					32·2	11·55	... ...	8·711	
39	Σ 196 ...	P. I. 122	1 52 55	20 26	51·8	2·62	8·5 ...11·0	7·666	
					52·1	2·36	... ...	7·856	
40	Σ 201 ...	ε Trianguli ...	1 55 58	32 42	116·8	4·10	5·3 ...11·3	7·810	
41	O Σ 38 ...	γ Andromedæ ...	1 56 32	41 45	102·7	0·48	5·0 ... 6·2	8·655	B and C.
					101·5	0·39	... ...	8·657	
42	Ijl V. 102 ...	61 Ceti	1 57 39	− 0 55	193·3	42·71	7 ...11	7 862	A and B.
					326·3	80·4	... ...	7·862	A and C.
43	Σ 223 ...	O[2] Arg. 2486 ...	2 6 9	80 10	50·7	0·78	8·0 ...10·4	8·660	
44	Σ 242 *rej.* ...	Ceti 346	2 10 20	−10 23	228·5	50·54	6–7...10	7·939	Mags. 7·0...9·0.
45	β 437 ...	L. 4291	2 12 26	3 39	33·4	7·08	8 ...12–13	7·942	
					31·5	7·24	... ...	7·953	
46	Ijl VI. 1 ...	o Ceti	2 13 17	− 3 31	91·5	74·11	2–7...13	7·818	A and B.
					82·8	115·62	10	7·818	A and C.
47	Σ 290 ...	... ...	2 33 13	− 2 25	220·6	10·25	8·1 ...10·1	7·698	Fixed.
48	Σ 295 ...	84 Ceti	2 35 4	− 1 12	324·3	4·73	6·0 ... 9·2	7·953	
49	Σ 293 ...	... ...	2 35 31	56 33	75·3	8·30	8·5 ...11·7	8·647	
50	Σ 303 ...	... ...	2 38 35	− 2 28	181·9	5·87	8·5 ... 9·5	7·859	
51	β 307 ...	L. 5133	2 40 29	29 11	315·4	14·91	7 ...11·5	7·725	
52	Ward ...	η Persei	2 41 56	55 24	268·3	67·03	4 ...10	8·151	A and C; AB = Σ 307.
					116·0	5·06	10 ...12	8 151	C and D.
					112·3	5·29	9·5 ...12	8·776	Unsteady.

No.	Double Star.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
			h m s	° ′	°	″			
53	Σ 310 ...	... ...	2 42 7	33 26	87·6	2·62	7·7 ...10·9	7·870	
54	OΣ 46 ...	L. 5205	2 42 45	30 2	167·5	20·66	7 ...19	7·725	A and C.
55	... ...	τ Persei	2 45 45	52 16	106·0	50·08	5 ...12	8·151	A and B.
					106·8	51·27	12	8·780	
					75·3	4·′ ±	13	8·151	A and C.
56	Σ 330 ...	Ceti 478	2 51 3	− 1 3	191·1	9·02	7·5 ... 9·5	7·862	
					191·9	8·36	... ...	7·939	
57	Σ 332 ...	W¹ ii. 878 ...	2 51 41	− 0 4	52·7	12·52	8·5 ... 8·5	7·859	
					54·1	12·52	... ...	7·931	
58	Σ 333 ...	ε Arietis	2 52 21	20 52	197·6	1·56	5·7 ... 6·0	7·725	
59	Σ 355 ...		3 0 54	7 56	147·8	2·64	8·7 ... 9·5	7·939	
60	Σ 356 ...	... ...	3 1 0	−13 47	13·3	15·59	7·7 ...10·8	7·829	No change.
61	Σ 358 ...	W¹ ii. 1091 ...	3 2 44	− 4 9	350·3	14·39	8·5 ...11·3	7·947	
62	β 400 ...	W¹ iii. 50 ...	3 5 18	− 4 16	53·2	21·69	7 ...11·5	7·947	
63	H. 663 ...	94 Ceti	3 6 37	− 1 39	250·9	5·73	5 ...19	7·698	
64	... ...	τ⁴ Eridani ...	3 14 12	−22 12	99·3	39·97	3½ ...11	7·810	A and C.
65	Σ 406 ...	... ...	3 24 28	4 45	124·2	9·65	7·0 ... 9·0	7·939	No change.
66	Σ 430 ...	Tauri 39	3 34 8	4 44	55·4	26·43	6·0 ... 9·0	8·030	A and B.
					301·0	37·74	9·8	8·030	A and C.
67	Σ 431 ...	40 Persei ...	3 34 46	33 35	238·0	19·98	4·2 ... 9 5	7·882	Fixed.
68	OΣ 61 *rej.* ...	L. 6847	3 36 18	7 31	127·8	1·87	7·2 ...10·0	7·942	
69	Σ 449 ...	... ...	3 40 17	24 17	330·1	7·05	8·5 ...11·0	7·870	
					331·5	6·83	... ...	8·096	
70	Σ 453 ...	Atlas Pleiadum ...	3 42 1	23 41	...	...	... ...	8·657	Single.
71	H. 338 ...	30 Eridani ...	3 46 47	− 5 43	135·3	8·34	5 ...17	7·966	
72	Σ 475 ...	... ...	3 52 3	− 7 28	22·5	7·34	8·2 ...10·6	7·862	
73	H. 3608 ...	γ Eridani ...	3 52 24	−13 51	238·0	51·0	3½ ...13	7·698	Single distance.
					238·5	51·79	... ...	7·942	B 12–13 m.
					238·6	52·07	... ...	8·003	H. 233°·6 : 45″ ±.
74	OΣ 531 ...	B.A C. 1264 ...	3 59 34	37 46	138 7	2·63	6·7 ... 8·9	8·655	
					138·4	2·57	... ...	8·671	
75	Σ 497 ...	... ...	4 2 3	8 8	235·2	14·16	8·5 ...10·7	7 939	Hazy.
76	Σ 499 ...	... ...	4 2 32	23 45	285·6	...	9·2 ... 9·3	8·093	A and B. Too poor for distance.
					281·1	29·92	11·2	8·093	AB and C.
77	OΣ 73 ...	μ Persei	4 6 5	48 6	348·6	14·88	4–5...12	8·151	B = 12–13 m.
78	OΣ 77 ...	L. 7899	4 8 17	31 24	244·4	0·37	7·8 ... 7·8	8·030	
					245·4	0·54	... ...	8·655	
					254·5	0·40	... ..	8·657	
					253·0	0·46	... ...	8·675	
79	Σ 518 ...	40 Eridani ...	4 9 52	− 7 47	129·0	3·64	10 ...11	7·701	B and C.
					129·3	4·05	... ...	7·810	

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			h m s	° ′	°	″			
					126·8	4·08	... ...	7·818	
					126·5	3·94	... ...	7·829	
					129·8	3·83	... ...	7·942	
					129·2	3·98	... ...	7·953	
					127·1	...	... ...	7·966	Clouded.
					146·0	38·01	... ...	7·701	A and *d*.
					145·5	36·87	... ...	7·818	
					145·4	36·43	... ...	7·829	
80	β 402 ...	W¹ iv. 318 ...	4 17 3	− 1 33	74·0	6·94	8·5...10·5	7·947	
81	H. 349 ...	W¹ iv. 327 ...	4 17 18	− 5 17	234·5	17·33	9 ...10	7·953	A and B. } Mags. 7·5, 9·0, and 12–13 ; no measures by H.
					84·3	28·73	17	7·953	A and C. }
82	Σ 547 ...	W¹ iv. 383 ...	4 19 48	− 1 40	8·7	2·45	8·5...11·5	7 947	
					10·8	2·47	... ...	7·953	
					10·0	2·01	... ...	8·063	
83	Σ 554 ...	80 Tauri	4 23 17	15 23	7·0	0·60	6·5... 9·0	8·030	
84	Σ 571 ...	... ...	4 30 3	− 3 51	258·2	17·30	6·3...11·0	8·003	
85	Σ 596 ...	... ...	4 40 15	−12 10	287·2	10·95	8·0...10·2	7·942	
					287·5	10·56	... ...	8·003	
86	Σ 609 ...	... ...	4 43 40	0 59	74·7	2·84	8·5... 8·7	8·093	Very unsteady.
					76·5	2·57	... ...	8·096	
87	Σ 607 ...	... ...	4 45 47	25 14	250·6	14·34	9·0...10·8	7·870	
					249·7	14·05	... ...	7·947	Mags. 9·0...11·0.
					250·5	13·97	... ...	8·099	
88	H. 3700 ...	O¹ Arg. 3467 ...	4 48 1	−20 58	347·8	26·20	7 ...14	7·942	H. 345°·3 : 20″ ± .
89	OΣ 92 ...	5 Aurigæ ...	4 52 3	39 13	247·4	2·78	5·7... 9·8	8·041	
90	Σ 639 ...		4 58 0	− 3 2	79·3	5·35	8·2... 9·0	8·003	Probably fixed.
91	OΣ 100 ..	W¹ v. 15	5 3 28	8 2	248·8	3·80	7·0...10·2	8·093	
92	OΣ 517 ...	L. 9802	5 7 14	1 50	137·6	6·20	6·2...13	8·093	AB and C.
93	ℍ VI. 30 ...	α Aurigæ ...	5 7 49	45 53	183·2	126·2	... ...	8·036	A and B. } Single distances. B = 12–13 m.
					146·2	158·6	... ...	8·036	A and C. }
94	OΣ 103 ...	16 Aurigæ ...	5 10 17	33 14	54·3	3·96	5·0...10·7	8·655	
95	β 188 ...	τ Orionis ...	5 11 47	− 6 58	62·1	...	... ...	7·810	B and *b*.
					49·5	3·53	... ...	7·829	
					52·1	4·49	... ...	7·947	
					50·3	4·13	... ...	8·153	
					249·1	36·20	4 ...14	7·947	A and B.
					60·0	36·09	...12	7·947	A and C.
96	β 190 ...	Orionis 82 ...	5 14 38	− 8 9	2·9	0·50	... ...	8·091	A and B. Well separated.
97	Ma. 1 ...	... ...	5 15 32	− 6 57	159·5	3·01	9 ... 9·5	7·862	A and B.
					137·7	34·6	... ...	7·862	A and C.
98	Σ 693 ...	... ...	5 15 37	− 2 10	12·5	3·87	8·7... 9·0	7·942	

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			h m s	° ′	°	″			
99	OΣ 107 ...	115 Tauri ...	5 20 10	17 52	308·4	10·18	6·0 ...11·0	7·870	
100	H. 365 ...	114 Tauri ...	5 20 26	21 50	346·9	37·80	5-6...17	7·870	A and B.
					193·9	58·82	...17	7·870	A and C.
					279·6	74·29	...17	7·870	A and D.
101	β 320 ...	β Leporis ...	5 23 6	−20 51	289·5	2·63	3·0 ...11·0	7·810	Mags. from De.
					291·5	2·86	... ...	7·829	
					288·0	2·56	... ...	7·994	
					284·9	2·45	... ...	8·030	
					289·6	2·63	... ...	8·170	
					286·3	2·96	... ...	8·197	
102	Σ 728 ...	32 Orionis ...	5 24 22	5 51	196·2	0·45	5·2 ... 6·7	8·030	
103	H. 3766 ...	α Leporis... ...	5 27 25	−17 55	154·8	36·02	3½ ...12	7·953	
104	Σ 748 ...	θ Orionis... ...	5 29 23	− 5 28	354·1	4·20	... ...	7·873	Fifth star.
					354·9	4·18	... ...	7·934	,,
					354·0	3·69	... ...	7·942	,,
					117·6	3·80	... ...	7·873	Sixth star.
					120·8	3·61	... ...	7·934	,,
					121·1	3·82	... ...	7·942	,,
105	β 90... ...	26 Aurigæ ...	5 30 56	30 25	113·2	25·86	... ...	7·870	A and C.
106	β 321 ...	Leporis 45 ...	5 33 59	−17 55	140·1	1·11	7·0 ... 8·5	8·170	A and *a*.
					359·8	1·72	9·0 ...10·5	8·170	C and *c*.
					136·0	87·85	... ...	8·178	*Aa* and *Cc*.
					136·2	88·82	... ...	8·197	
					31·8	51·33	...10	8·178	*Cc* and G.
					48·7	60·3	... ...	8·170	A and E.; single distance.
					310·4	41·79	... ...	7·994	A and *x*.
107	Σ 782 ...	W¹ v. 908 ...	5 36 47	− 0 2	307·9	39·44	7·8 ... 8·3	7·942	
108	β 192 ...	τ Aurigæ... ...	5 40 52	39 8	350·0	38·93	5 ...12+	7·824	A and B.
					32·9	47·85	12	7·824	A and C = ℍ V. 21.
109	H. 3279 ...	133 Tauri ...	5 40 54	13 51	298·6	17·87	6 ...16	7·870	H. 250°·1 : 182°·0.
					181·2	24·95	...15	7·870	
110	OΣ 119 ...	L. 10974	5 41 24	7 55	314·0	0·61	7·7 ... 8·2	8·030	
					316·8	0·77	... ...	8·170	
111	β 405 ...	W¹ v. 1045 ...	5 42 22	−13 34	125·1	14·50	8·5 ...11·0	7·953	
112	β 406 ...	W¹ v. 1068 ...	5 43 1	−13 28	243·1	12·01	9·0 ...12·0	7·953	
113	ℍ V. 90 ...	ν Aurigæ ...	5 43 10	39 7	207·0	54·97	... ...	7·824	
114	De. 10 ...	Arg. (29°) 1027 ...	5 45 6	29 45	164·8	2·56	8·5 ...11·5	7·882	A and B.
115	β 95... ...	... ...	5 46 8	− 7 20	298·2	13·67	8·0 ...12·0	8·156	Near 55 Orionis.
116	... ...	α Orionis... ...	5 48 40	...	348·2	75·91	B = 12-13	7·942	A and B.
					348·8	78·68	... ...	7·953	
					346·9	78·17	... ...	8·003	

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			h m s	° ′	°	″			
117	S. 503 ...	W¹ v. 1206 ...	5 49 10	13 56	157·3	28·09	7 ...13	8·003	A and C.
					167·8	...		8·003	B and C.
118	OΣ 121 ...	R. 1582	5 49 49	74 0	185·3	0·32	7–8... 8–9	8·151	Well separated.
119	OΣ 545 ...	θ Aurigæ ...	5 51 32	37 12	3·8	1·90	3·0 ... 7·5	8·041	A and B.
					292·7	45·51	10	8·041	A and C.
120	ℍ V. 100 ...	59 Orionis ...	5 52 10	1 49	205·8	36·57	6	8·178	ℍ 37″·25 (1783·0).
121	Σ 826 ...	... ...	5 52 49	− 1 20	126·7	2·02	8·2 ... 9·2	7·453	
					124·7	2·35	... ...	7·994	
122	Σ 848 ...	... ...	6 1 42	13 59	295·4	15·55	7·3 ...12·0	8·003	A and *e*.
123	β 96... ...	75 Orionis ...	6 10 29	9 59	226·5	4·74	9 ...11·5	7·934	B and C.
124	Σ 903 ...	... ...	6 18 49	− 12 54	294·3	22·73	7·0 ...11·0	8·189	Unsteady.
125	Σ 910 ...	P. VI. 105 ...	6 20 36	0 31	162·5	0·93	8·3 ... 9·0	8·197	B and C.
126	Σ 938 ...	14 Monocerotis ...	6 28 16	7 40	209·9	10·59	7·0 ...11·2	8·197	
127	Σ 943 ...	Arg. (23°) 1432 ...	6 30 33	23 17	147·4	19·65	8·5 ... 9·0	8·175	
128	H. 397 ...	W² vi. 961 ...	6 33 47	28 19	56·8	55·72	8 ...13	8·882	
129	Σ 951 ...	W¹ vi. 978 ...	6 33 51	9 56	309·2	21·43	8·5 ...10·7	8·156	A & B. No change.
					229·2	11·56	... ...	8·156	B & C. C found by Ward.
130	Σ 955 ...	... ...	6 35 24	− 7 53	272·2	1·00	8·7 ... 9·0	8·063	A and B.
					189·4	11·48	8·5	8·063	A and C.
131	OΣ 154 ...	L. 12831	6 35 52	40 45	129·0	27·77	6·2 ... 8·2	8·041	
132	OΣ 155 ...	L. 12941	6 38 1	24 48	261·0	15·23	6·8 ...10·5	8·091	
					258·5	14·92	... ...	8·175	
133	A. G. C. 1 ...	Sirius	6 39 53	−16 33	52·9	10·24	... ...	7·873	A and B.
					54·0	10·68	... ...	7·934	
					53·4	10·34	... ...	7·942	
					52·6	11·36	... ...	7·947	
					53·0	11·13	... ...	7·994	
					51·9	11·32	... ...	8·030	
					51·3	11·19	... ...	8·036	
					50·2	10·70	... ...	8·041	
					113·5	...	... ...	7·873	A and C.
					115·1	71·30	... ...	7·994	
					112·3	71·37	... ...	8·036	
					158·9	104·60	... ...	7·873	A and D.
					158·5	103·32	... ...	7·994	
134	Σ 966 ...	Arg. (40°) 1729 ...	6 41 52	40 5	111·7	5·35	8·2 ...10·2	8·041	No change.
135	A. C. 4 ...	Canis Majoris 89...	6 43 32	−15 1	295·4	1·10	6½ ... 9	8·030	
136	OΣ 159 ...	15 Lyncis ...	6 46 54	58 35	1·0	0·48	4·7 ... 7·2	8·151	A and B.
					31·4	23·64	12–13	8·151	AB and C.
137	OΣ 160 ...	L. 13275	6 47 11	21 19	174·2	1·43	7 ...10	8·156	Difficult to-night.
138	Σ 990 ...	... ...	6 48 51	−14 6	273·1	3·41	8·7 ... 9·3	8·156	No change.

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			h m s	° ′	°	″			
139	Σ 992 ...	... ...	6 49 55	− 9 20	299·6	13·75	8·0... 9·5	8·159	No change.
140	OΣ 162 *rej.* ...	41 Geminorum ...	6 52 57	16 7	155·8	21·41	7 ...10	8·170	
					153·9	20·55	... ...	8·189	Excessively unsteady.
141	... ...	ε Canis Majoris ...	6 53 54	−28 48	160·2	7·42	2 ... 9	8·219	
142	Σ 1014 ...	... ...	6 58 20	26 19	38·9	1·82	8·7... 8·7	8·057	Windy.
					36·3	1·88	... ...	8·063	Σ 32°·2 : 2″·09 (1830·2).
143	OΣ 165 ...	45 Geminorum ...	7 1 29	16 9	76·5	2·56	5 ...10–11	8·030	
					79·7	2·34	... ...	8·214	B = 12–13 m.
144	Σ 1031 ...	W¹ vii. 22 ...	7 3 2	−13 48	248·3	3·33	8·3... 9·0	8·175	Poor seeing.
145	Σ 1034 ...	W¹ vii. 37 ...	7 3 35	− 8 7	18·7	2·64	8·7... 9·2	8·088	Fixed.
146	Σ 1058 ...		7 10 3	9 37	...	...	... ...	...	No companion.
147	Σ 1064 ...	Canis Majoris 163.	7 11 30	−11 49	239·6	14·96	7·0... 9·7	8·088	
148	Σ 1074 ...	... ...	7 14 21	0 38	146·0	0·71	7·8... 8·2	8·030	
149	Σ 1071 ...	... ...	7 14 22	45 14	7·3	16·24	8·2...10·2	8·041	
150	Σ 1081 ...	... ...	7 17 1	21 41	226·1	1·36	7·8... 8·5	8·091	
151	OΣ 172 *rej.* ...	L. 14465	7 21 34	35 3	245·3	12·±	7 ...11	8·159	No prior measures.
152	... ...	γ Canis Minoris ...	7 21 38	9 10	243·2	32·60	... ...	8·063	
153	Σ 1097 ...	P. VII. 116 ...	7 22 14	−11 19	313·5	20·21	6·0... 8·7	8·159	AB and C
					157·3	23·35	9·8	8·099	AB and D
					157·2	23·47		8·159	
					41·4	31·06	12–13	8·159	AB and E.
154	H. 760 ...	... ...	7 25 11	− 0 52	355·3	29·92	6 ...20	8·088	
155	OΣ 175 ...	B.A.C. 2489 ...	7 27 31	31 13	334·9	...	5·5... 6·3	8·236	Too windy for distance.
156	... ...	Procyon	7 33 1	5 33	316·9	44·71	... ...	7·810	
					317·6	44·53	... ...	7·953	
157	Σ 1142 ...	... ...	7 41 40	13 43	254·5	22·84	8·0...10·4	8·225	
158	Σ 1143 ...		7 41 41	5 42	...	...	7·0...11·0	8·063	No companion.
159	Σ 1152 ...	... ...	7 44 58	− 2 49	314·1	6·05	8·2... 9·9	8·225	
160	Σ 1154 ...		7 46 7	− 2 45	352·9	2·41	7·7... 9·9	8·225	
161	β 101 ...	9 Argûs	7 46 12	−13 35	305·3	1·19	5·2... 6·5	8·170	Doubtful distance.
					298·8	...		8·214	Too poor for distance.
					303·6	0·41	... ...	8·227	Good.
162	OΣ 183 *rej.* ...	... ...	7 47 8	16 21	19·8	16·46	7 ...11	8·057	Difficult, and not well seen.
					18·9	15·67	... ...	8·088	
					20·7	16·43	... ...	8·225	B = 12–13 m.
163	Σ 1171 ...	Cancri 5	7 53 51	23 55	333·8	2·93	6·2...10·7	8·063	
164	Σ 1175 ...	... ...	7 56 6	4 29	222·5	1·81	7·8... 9·7	8·088	
165	Σ 1213 ...	... ...	8 11 32	6 50	325·1	7·43	9·0...11·5	8·225	
166	Σ 1216 ...	... ...	8 15 15	− 1 13	158·4	0·47	7·5... 8·2	8·068	
					156·3	0·65	... ...	8·091	
					159·6	0·84	... ...	8·219	Distance too large.
					160·8	0·50	... ...	8·227	First-rate measure.

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			h m s	° ′	°	″			
167	O Σ 193 ...	L. 16548	8 20 34	33 56	298·1	14·17	7·2...12·0	8·041	
168	Σ 1230 ...	... ...	8 21 37	17 15	192·7	29·90	8·3...10·0	8·219	
169	Σ 1233 ...	P. VIII. 81 ...	8 22 26	− 2 7	330·3	18·15	7·2...11·5	8·099	No change.
170	Σ 3119 ...	W¹ viii. 638 ...	8 26 7	8 54	215·9	26·21	8·0...11·0	8·225	= Σ 3066 *rej.*
171	H. 457 ...	δ Cancri	8 37 54	18 36	113·9	41·08	5 ...15	8·239	
172	Σ 1273 ...	ε Hydræ	8 40 25	6 52	223·1	3·46	3·8... 7·8	8·225	A and B.
					192·2	20·50	... ...	7·994	A and C.
173	Σ 1281 ...	... ...	8 41 26	0 28	321·3	31·18	7·8... 8·9	8·091	
174	A. G. C. 3 ...	ρ Hydræ	8 42 5	6 17	145·9	12·16	5 ...12–13	7·994	
					143·9	12·84	... ...	8·057	
					144·9	12·19	... ...	8·170	
175	β 24... ...	L. 17586	8 48 24	− 8 18	177·3	1·12	7·8... 9·0	8·186	
176	Σ 1327 ...	L. 18224	9 8 26	28 25	77·8	13·47	8·0... 9·2	8·131	A and B.
177	Σ 1329 ...	... ...	9 9 37	− 0 44	248·4	22·84	8·3... 8·5	8·131	
178	Σ 3121 ...	W² ix. 176 ...	9 10 46	29 5	185·2	0·36	7·5... 7·8	8·211	
179	Σ 1356 ...	ω Leonis	9 22 2	9 35	68·0	0·73	6·2... 7·0	8·068	
					72·6	0·53	... ...	8·153	
180	H IV. 47 ...	3 Leonis	9 22 6	8 43	78·7	25·33	6½ ...13	8·186	Mags. from Sm.
181	O Σ 207 *rej.* ...	L. 19259	9 43 17	17 24	323·2	19·24	7·7...11·2	8·285	
182	Σ 1385 ...	... ...	9 43 23	17 7	356·9	...	8·5...10·7	8·186	Too poor for distance.
					350·5	1·14	... ...	8·211	
183	A. C. 5 ...	8 Sextantis ...	9 46 34	− 7 32	150·0	0·2 ±	5½ ... 5¾	8·208	Slight elongation with 900.
					172·0	...	... ...	8·323	Less than 0″·25.
184	Anderson ...	A, 31 Leonis ...	10 1 32	10 35	42·6	8·25	5 ...13–14	8·153	
					45·8	7·01	... ...	8·323	Only seen with low power.
185	Winlock ...	α Leonis (Regulus)	10 2 0	12 33	90·8	3·21	8·4...13	8·041	B and C.
					84·9	3·47	... ...	8·063	
					88·6	3·27	... ...	8·153	
					89·8	3·23	... ...	8·323	
186	Σ 1416 ...	... ...	10 6 29	−15 30	276·7	11·84	6·7... 8·5	8·285	
187	O Σ 215 ...	P. X. 23	10 9 44	18 20	225·4	0·65	6·5... 7·3	8·068	
188	O Σ 523 ...	39 Leonis ...	10 10 39	23 43	297·9	7·05	5·8...11·5	8·041	
					299·5	6·29	... ...	8·249	
189	Σ 1423 ...	... ...	10 12 37	21 10	69·7	1·28	8 6... 9·3	8·211	
190	H. 4311 ...	L. 20158	10 17 26	−12 46	124·3	3·88	7 ...14	8·416	
191	Σ 1445 ...	... ...	10 26 35	− 0 15	160·0	2·71	8·8...11·8	8·285	
192	H. 165 ...	W¹ x. 499 ...	10 29 46	12 14	205·3	2·59	8 ... 9	8·285	Mags. 8·5...8·5.
193	O Σ 226 *rej.* ...	L. 20595	10 33 47	42 9	58·4	17·89	7 ...10	8·151	
194	H. 838 ...	41 Sextantis ...	10 44 17	− 8 16	303·8	26·95	6 ...17–18	8·186	Not measured by H.
195	De. 14 ...	... ...	10 45 51	− 6 33	193 1	5·86	8·0...11·2	8·131	A and B.
					195·1	6·19	... ...	8·417	

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			h m s	° ′	°	″			
196	O Σ 230 ...	L. 20971	10 48 4	21 35	13·4	8·36	8·0 ... 12·0	8·239	
197	Σ 1524 ...	ν Ursæ Majoris ...	11 12 0	33 45	146·0	7·07	3·7 ... 10·1	8·260	No change.
198	Σ 1543 ...	57 Ursæ Majoris...	11 22 37	40 0	7·1	5·43	5·2 ... 8·2	8·425	
199	O Σ 234 ...	L. 21874	11 24 20	41 57	187·1	0·35	7 ... 7–8	8·246	Distance too large.
					151·7	0·27	... ...	8·323	Very good.
200	Σ 3072 ...	P. XI. 91... ...	11 24 44	− 6 3	330·0	9·53	7·4 ... 10·4	8·244	Unchanged.
201	H. 1201 ...	B.A.C. 4005 ...	11 44 48	12 54	190·0	14·75	6–7 ... 13	8·244	H. 189° 0 : 12″ ± .
202	O Σ 243 ...	R. 2777	11 53 38	54 4	14·5	0·94	8·3 ... 9·0	8·296	
203	Σ 1607 ...	... ...	12 5 30	36 45	358·1	30·85	7·8 ... 8·3	8·260	A and B.
					309·8	21·04	... ...	8·260	B and C.
204	H. 203 ...	W¹ xii. 94 ...	12 8 6	− 5 3	351·6	30·20	6 ... 19	8·244	A and B. No other measure.
					197·7	...	14	8·244	A and C. B = 12 m.
205	O Σ 245 ...	W² xii. 199 ...	12 11 28	29 36	278·1	7·83	6·2 ... 10·5	8·291	
206	O Σ 246 ...	R. 2828	12 12 24	69 28	...	...	7–8	8·299	Certainly round.
207	Σ 1630 ...	... ...	12 13 3	57 2	171·5	2·59	8·3 ... 9·0	8·299	
208	Σ 1632 ...	Canes Ven. 20 ...	12 14 15	38 34	192·1	10·48	6·5 ... 9·7	8·249	No change.
					192·4	10·10	... ...	8·396	
209	O Σ 247 *rej.* ...	W¹ xii. 237 ...	12 16 10	3 58	...	...	7	8·323	Absolutely round with 925.
210	O Σ 248 *rej.* ...	L. 23206	12 18 3	6 38	...	...	7	8·323	
211	O Σ 249 ...	R. 2853	12 18 3	54 49	307·1	0·46	7·5 ... 8·0	8·299	A and B.
					148·3	12·68	11·0	8·299	A and C.
212	O Σ 250 ...	L. 23220	12 18 31	43 45	329·0	0·47	7·5 ... 7·7	8·151	
213	Σ 1641 ...	... ...	12 18 38	38 24	39·2	8·94	10·0 ... 10 5	8·260	
					39·3	8·99	... ...	8·291	
214	Σ 1643 ...	... ...	12 21 13	27 42	46·6	1·76	8·4 ... 8·7	8·291	
215	Σ 1644 ...	... ...	12 21 18	8 3	246·3	21·15	8·7 ... 9·2	8·285	
					247·2	20·97	... ...	8·323	
216	Σ 1675 ...	... ...	12 38 40	35 4	8·2	30·66	8·3 ... 9·0	8·260	
217	O Σ 255 *rej.* ...	W¹ xii. 564 ...	12 40 8	3 7	337·6	20·20	7 ... 10	8·285	B = 12 m.
218	Σ 1682 ...	P. XII. 196 ...	12 45 8	− 9 41	305·6	32·48	6·7 ... 9·0	8·255	
					306·2	32·10	... ...	8·274	
					305·5	32·47	... ...	8·285	
219	H. 522 ...	30 Comæ ...	12 45 51	28 13	10·0	43·17	6 ... 18	8·151	No other measures.
220	Σ 1702 ...	... ...	12 52 56	38 56	82·5	35·73	8·0 ... 8·5	8·260	
221	Σ 1703 ...	L. 24179	12 53 7	8 33	281·1	18·86	8·0 ... 11·0	8·274	
					282·6	18·59	... ...	8·359	
					280·8	18·92	... ...	8·244	
222	A. G. C. 6 ...	46 Virginis ...	12 54 25	− 2 43	154·3	1·46	6·0 ... 11·0	8·323	A and B.
					148·7	1·51	... ...	8·359	
					116·9	33·86	13	8·277	A and C.
223	Σ 1705 ...	... ...	12 54 49	15 2	188·0	26·84	8·2 ... 9·7	8·353	No change.

No.	Double Star.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
			h m s	° ′	°	″			
224	Σ 1707 ...	... ...	12 55 17	16 31	35·2	9·70	8·5 ...10·3	8·274	
					35·8	9·99	... ...	8·285	
225	Σ 1711 ...	... ...	12 56 54	14 7	349·7	1·06	8·5 ... 9·0	8·285	
226	H. 2638 ...	P. XII. 268 ...	13 0 27	29 40	218·9	6·54	6 ...14	8·422	A and B. }
					7·2	40·28	15	8·422	A and C. } C faint.
227	Σ 1727 ...	... ...	13 4 12	32 1	337·8	7·70	8·7 ...10·2	8·291	
					335·4	7·56	... ...	8·422	
228	H. 2645 ...	53 Virginis ...	13 5 40	−15 33	9·3	70·80	... ...	8·236	B = 12–13.
229	ℍ VI. 90 ...	61 Virginis ...	13 12 10	−17 38	25·7	...	4½ ...10½	8·285	
					24·8	189·96	... ...	8·353	
230	Σ 1737 ...	P. XIII. 63 ...	13 15 58	18 24	220·2	15·13	7·7 ...10·0	8·274	
231	β 460 ...	W¹ xiii. 273 ...	13 18 40	−15 0	33·6	1·99	8·0 ...10·5	8·277	
232	OΣ 268 *rej.*...	L. 25006	13 25 11	24 51	77·1	19·61	7 ...11·8	8·274	A and B. }
					259·0	67·86	7	8·274	A and C. }
233	H. 2659 ...	W³ xiii. 542 ...	13 28 11	40 33	...	...	8–9...18	8·260	
234	H. 3340 ...	... ...	13 30 47	16 35	217·2	2·27	11 ...11	8·244	
235	H. 3341 ...	W² xiii. 615 ...	13 32 14	28 56	191·4	2·80	10 = 10	8·151	Mags. 10...10·5.
					196·2	2·56	... ...	8·274	
236	Σ 1771 ...	... ...	13 33 32	70 23	75·8	1·97	7·8 ... 8·5	8·299	
237	Σ 1775 ...	B.A.C. 4571 ...	13 37 17	− 3 40	335·4	27·93	7·0... 9·7	8·255	
					336·4	27·68	... ...	8·277	
238	Σ 3081 ...	W¹ xiii. 645 ...	13 38 46	−11 14	67·4	2·05	8·8 ... 9·2	8·277	
					67·0	1·99	... ...	8·285	
239	OΣ 270 ...	τ Boötis	13 41 35	18 3	351·0	8·95	4·8 ...11·7	8·151	
					351·4	8·94	... ...	8·244	
					352·9	8·31	... ...	8·337	
					352·2	8·66	... ...	8·422	
240	Σ 1784 ...	... ...	13 42 12	69 49	208·7	9·00	8·2 ...10·5	8·299	
241	OΣ 272 ...	P. XIII. 242 ...	13 49 1	30 30	20·9	1·41	7·2 ... 9·7	8·291	
242	Σ 1791 ...	... ...	13 51 1	15 1	159·7	21·12	8·7 ... 9·5	8·274	
243	Σ 1801 ...	... ...	13 59 42	6 32	66·9	19·38	9·0 ...10·5	8·277	
					68·1	19·37	... ...	8·348	
244	Σ 1803 ...	... ...	14 1 24	38 59	42·6	17·87	7·7 ... 9·5	8·260	Fixed.
245	Σ 1805 ...	... ...	14 3 55	4 35	34·5	4·70	8·4 ... 8·5	8·277	
246	Σ 1809 ...	... ...	14 4 14	46 42	194·8	4·09	8·5 ...11·7	8·291	
247	Σ 1820 ...	... ...	14 9 5	55 53	67·4	2·32	8·2 ... 8·5	8·299	
248	Σ 1827 ...	O². Arg. 14419 ...	14 10 32	59 48	210·8	11·35	8·5 ... 9·0	8·296	Fixed.
249	Σ 1832 ...	... ...	14 12 51	4 27	131·4	0·65	9·0 ... 9·0	8·323	A and B. }
					69·6	19·16	(14)	8·323	A and C. }
250	Σ 3083 ...	Arg. (24°) 2719 ...	14 14 12	24 4	230·7	4·48	8·3 ...11·0	8·337	
251	Σ 1843 ...	... ...	14 20 15	48 23	187·7	20·02	7·2 ... 8·7	8·260	

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			h m s	° ′	°	″			
252	Σ 1847 ...	... ...	14 22 14	− 9 40	258·0	22·68	8·5... 9·8	8·274	
					257·6	22·58	... ...	8·348	
253	OΣ 283 ...	R. 3220	14 28 17	49 43	132·4	5·05	7·5...11·0	8·260	
					129·8	4·95	... ...	8·296	
254	OΣ 284 ...	R. 3245	14 36 6	49 13	103·5	7·23	7·3...11·0	8·260	
					101·3	7·11	... ...	8·296	
255	Σ 1870 ...	... ...	14 37 1	8 35	230·5	4·56	7·8...10·7	8·285	
					231·0	4·45	... ...	8·348	
256	Σ 1874 ...	... ...	14 38 1	49 38	288·6	26·32	7·7... 9·2	8·260	
257	Σ 1879 ...	... ...	14 40 23	10 10	217·1	0·42	7·8... 8·8	8·438	
258	β 106 ...	μ Libræ	14 42 44	−13 39	333·2	1·50	5·5... 6·3	8·321	A and B.
					229·2	27·35	12–13	8·321	A and C.
259	H. 5489 ...	B.A.C. 4902 ...	14 44 48	29 7	23·0	112·56	... ...	8·337	
260	β 31 ...	L. 27106	14 46 59	19 13	187·8	1·29	8·5...10·2	8·246	A and B.
					161·4	9·04	12–13	8·246	A and C.
261	H. 2752 ...	Arg. (45°) 2228 ...	14 47 4	45 6	126·5	5·84	9 ...10	8·260	Mags. 8...10·5.
262	Sh. 190 ...	P. XIV. 212 ...	14 50 27	−20 52	291·3	15·67	7 ... 8	8·277	A and B.
					290·4	15·05	... ...	8·323	
					291·8	15·40	... ...	8·348	
					289·5	15·20	... ...	8·509	
					171·0	52·5	... ...	8·323	A and C.
					52·5	69·4	... ...	8·323	A and D.
					166·5	105·5	... ...	8·323	A and E.
					322·2	121·6	... ...	8·323	A and F.
263	β 239 ...	59 Hydræ ...	14 51 33	−27 10	129·5	0·93	6 ... 6	8·362	
264	β 348 ...	2 Serpentis ...	14 55 40	0 20	121·4	0·51	6 ... 7·5	8·362	Very difficult.
265	Σ 1914 ...	... ...	15 5 25	− 5 2	335·4	30·91	8·0... 8·7	8·277	
					336·2	31·74	... ...	8·351	
266	Σ 3091 ...	... ...	15 9 43	− 4 26	225·0	0·25 ±	7·7... 7·7	8·362	
267	OΣ 294 ...	L. 27867	15 9 46	56 30	249·1	...	7·3...11·0	8·296	Clouded before distance.
					248·3	2·75	... ...	8·299	
268	Σ 1926 ...	... ...	15 10 23	38 45	254·8	1·46	6·1... 8·4	8·422	Unsteady.
					259·1	1·43	... ...	8·444	Good.
269	OΣ 295 ...	L. 27853	15 10 24	37 16	128·7	0·75	8·0... 9·3	8·411	
270	Σ 1925 ...	... ...	15 10 28	− 7 50	10·2	4·91	7·8... 9·3	8·438	
271	Σ 3093 ...	L. 28015	15 16 26	− 1 6	139·9	30·79	8·0... 9·2	8·348	
272	Σ 1937 ...	η Coronæ	15 18 14	30 43	90·8	0·62	5·2... 5·7	8·411	
273	Σ 1938 ...	μ^2 Boötis	15 20 0	37 46	136·2	0·68	6·7... 7·3	8·411	
274	... ...	γ Libræ	15 28 48	−14 23	151·8	41·31	4½...11·7	8·323	
275	Σ 1959 ...	W² xv. 668 ...	15 29 58	35 10	242·3	2·08	8·7...10·2	8·411	No change.
276	Σ 1961 ...	Arg. (44°) 2483 ...	15 30 29	43 56	44·6	22·45	8·7... 9·0	8·291	

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			h m s	° ′	°	″			
277	OΣ 298 ...	W² xv. 716 ..	15 31 42	40 13	128·7	0·23	7·0... 7·4	8·249	Not quite separated.
					132·8	0·31	... ...	8·411	Both good measures.
278	Σ 1962 ...	Libræ 178 ...	15 32 11	− 8 24	187·8	11·99	6·3... 6·4	8·487	Fixed.
279	Σ 1964 ...	... ...	15 33 41	36 38	10·0	1·34	8·8	8·381	B and C.
					88·1	15·52	6·8... 7·3	8·381	A and B.
280	Σ 3095 ...	W¹ xv. 705 ...	15 36 15	−14 48	337·8	2·72	8·3... 9·8	8·452	
					337·9	2·95	... ...	8·455	
281	H 1277 ...	α Serpentis ...	15 38 21	6 48	354·5	58·89	2 ...14–15	8·351	H. 359°·5.
282	A. G. C. 8 ...	ε Coronæ ...	15 52 37	27 14	357·3	1·94	4 ...12–13	8·246	
					3·1	1·78	... ...	8·473	
283	Σ 2001 ...	... ...	15 57 10	42 10	168·8	11·93	8·7...10·5	8·291	
284	Σ 2006 ...	... ...	15 58 1	59 16	196·8	1·66	7·5... 9·2	8·425	
285	β 120 ...	ν Scorpii	16 5 1	−19 9	0·8	0·8 ±	4·2... 6·7	8·244	Too poor for distance.
					7·2	1·08	... ...	8·383	Unsteady.
					3·0	1·00	... ...	8·438	
286	Σ 2022 ...	... ...	16 7 48	26 59	136·4	2·89	6·2... 9·8	8·444	
287	Σ 2032 ...	σ Coronæ ...	16 10 12	34 10	202·8	...	5·0... 6·1	8·378	Clouded before distance.
					201·8	3·51	... ...	8·400	The 16″ star not seen.
288	Σ 2036 ...	... ...	16 10 29	72 52	241·5	2·18	8·8...10·3	8·425	A and B.
					341·1	15·67	16	8·425	A and C.
289	Σ 2048 ...	P. XVI. 88 ...	16 22 20	− 7 52	301·3	5·04	6·3... 9·0	8·493	Probably fixed.
290	OΣ 312 ...	Draconis ...	16 22 22	61 47	141·7	5·26	2·9... 9·0	8·381	
291	Σ 3105 ...	W¹ xvi. 447 ...	16 25 21	− 6 46	50·9	0·61	7·7... 7·7	8·493	
292	Σ 2062 ...	... ...	16 28 42	8 56	114·2	2·80	8·3...10·0	8·458	B = 11 m.
293	Σ 2084 ...	ζ Herculis ...	16 36 47	31 49	127·0	1·51	3·0... 6·5	8·408	
294	Σ 2092 ...	... ...	16 37 24	60 56	5·2	8·18	7·7... 8·8	8·425	
295	Σ 2106 ...	... ...	16 45 24	9 37	323·7	0·64	6·7... 8·4	8·383	
296	Σ 3106 ...	W¹ xvi. 912 ...	16 49 17	− 4 59	247·2	2·19	8·6... 8·6	8·482	
					246·4	...	... ...	8·487	Haze; too faint for distance.
297	OΣ 317 ...	L. 30818	16 49 18	44 36	228·1	17·30	7 ...11–12	8·299	
					228·9	17·29	... ...	8·337	
298	Σ 2110 *rej.* ...	56 Herculis ...	16 50 6	25 56	93·4	18·13	6½ ...10	8·449	
299	Σ 3107 ...	W¹ xvi. 977 ...	16 52 52	4 9	100·1	1·38	8·5... 8·5	8·458	
300	OΣ 321 ...	L. 30918	16 53 55	14 29	2·6	0·55	8·0... 8·0	8·458	
301	Σ 2117 ...	... ...	16 55 14	51 59	116·3	1·29	8·4...10·6	8·299	Difficult to-night.
302	Σ 2115 ...	Herculis 192 ...	16 56 6	15 7	238·5	18·88	5·7...10·5	8·383	
303	Σ 2124 ...	... ...	16 58 47	65 23	89·4	15·04	8·5... 9·2	8·299	No change.
304	ΨΙ V. 133 ...	60 Herculis ...	16 59 49	12 54	309·7	...	... ...	8·438	Clouded.
					309·8	53·38	... ...	8·515	
305	Σ 2122 ...	Ophiuchi 124 ...	17 0 39	− 1 30	279·6	20·34	6·5... 8·7	8·482	Fixed.
306	Σ 2140 ...	α Herculis ...	17 9 10	14 32	117·5	4·99	3·0... 6·1	8·458	A and B.
					38·7	85·39	12–13	8·458	A and C.

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			h m s	° ′	°	″			
307	H. 854 ...	W¹ xvii. 143 ...	17 10 27	1 21	358·8	20·24	5 ...17	8·509	No other measures.
308	OΣ 327 ...	R. 3689	17 11 53	56 16	...	...	... ...	8·476	
309	OΣ 328 ...	68 Herculis ...	17 12 54	33 14	62·4	3·88	5·1...10·1	8·395	No change.
					60·6	4·22	... ...	8·411	Good.
310	σ 544 ...	72 Herculis ...	17 16 10	32 28	...	...	6	8·395	
311	Σ 2163 ...	... ...	17 19 36	42 16	97·2	1·58	9·2... 9·2	8·299	
312	Σ 2172 ...	... ...	17 23 44	− 1 15	170·5	11·62	8·0...10·8	8·509	
313	Σ 2175 ...	... ...	17 25 0	32 48	10·1	13·30	8·0...10·0	8·395	No change.
314	Σ 2178 ...	... ...	17 25 11	35 2	...	...	7·0... 8·6	8·449	
315	Σ 2190 ...	P. XVII. 163 ...	17 30 52	21 4	23·9	10·16	6·0... 9·5	8·493	
316	OΣ 333 ...	... ...	17 31 13	10 39	...	...	7	8·622	Single.
317	De. 16 ...	Arg. (43°) 2795 ...	17 39 45	43 48	147·9	0·97	9·5...11·0	8·299	B and C.
					212·7	19·45	8·5	8·299	A and BC.
318	Σ 2205 ...	... ...	17 40 ±	17 46	305·1	2·30	8·3... 8·7	8·622	
319	A. C. 7 ...	μ Herculis ...	17 41 47	27 48	233·1	1·04	... ...	8·337	B and C.
					237·8	0·92	... ...	8·411	
					229·5	1·16	... ...	8·444	Unsteady.
					235·7	1·02	... ...	8·473	Seeing perfect.
					234·6	1·22	... ...	8·529	
					238·9	0·95	... ...	8·610	Good.
					243·4	30·54	... ...	8·444	A and BC.
320	Σ 2215 ...	W² xvii. 1314 ...	17 41 49	17 44	301·1	0·71	5·9... 7·9	8·622	
321	Σ 2237 ...	... ...	17 46 14	41 59	7·4	20·28	7·2... 9·5	8·299	No change.
322	Σ 3128 ...	W¹ xvii. 905 ...	17 46 28	− 7 53	35·0	1·25	7·2...11·0	8·323	
323	OΣ 338 ...	L. 32693	17 46 33	15 21	202·9	0·75	6·4... 7·7	8·636	
324	H. 4995 ...	L. 32695	17 47 26	−11 19	...	...	6½	8·512	
325	β 283 ...	B.A.C. 6088 ...	17 54 38	−22 47	238·3	8·20	6 ...12–13	8·504	No other measures.
					240·1	8·26	... ...	8·507	
326	ℍ N. 40 ...	L. 32971	17 55 6	−23 1	21·4	5·98	... ...	8·501	A and B.
					22·6	5·73	... ...	8·504	
					212·4	10·85	... ...	8·501	A and C.
					282·5	2·18	... ...	8·501	C and D.
					280·2	2·26	... ...	8·504	
					182·5	6·10	... ...	8·512	C and E.
					214·5	29·71	... ...	8·512	C and G.
					82·1	28·37	... ...	8·512	C and F.
327	Σ 2272 ...	70 Ophiuchi ...	17 59 23	2 33	...	...	... ...	8·625	Both stars round.
328	H. 5493 ...	72 Ophiuchi ...	18 1 42	9 33	167·6	51·70	4 ...14	8·622	
329	A.C. 15 ...	99 Herculis ...	18 2 28	30 33	26·6	1·09	6·0...10·5	8·458	
					20·6	0·90	11·0	8·460	
					26·1	0·97	... ...	8·473	

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			h m s	° ′	°	″			
330	A. G. C. ...	102 Herculis ...	18 3 38	20 48	46·9	23·42	5½ ...12–13	8·449	
331	H. 2822 ...	μ Sagittarii ...	18 6 35	−21 5	259·2	16·91	3–4...14	8·422	A and B.
					117·4	...	... ...	8·422	A and C.
					118·7	25·20	... ...	8·512	
332	β 286 ...	16 Sagittarii ...	18 8 9	−20 25	219·6	5·49	6 ...13	8·490	
					218·3	5·74	... ...	8·504	
					217·7	5·78	... ...	8·701	
333	H. 2827 ...	... ...	18 9 59	−19 55	253·6	19·67	9–10=9–10	8·422	
334	β—— ...	R. 3883	18 12 35	56 33	186·1	5·99	11·0 ...11·0	8·425	B and C.
					239·3	95·96	7·0	8·425	A and B.
335	H. 5495 ...	74 Ophiuchi ...	18 14 53	3 19	285·6	27·96	5 ...15	8·512	No other measures.
336	Σ 2315 ...	Herculis 452 ...	18 20 12	27 20	251·7	0·31	7·0 ... 8·0	8·449	
337	Σ 2318 ...	... ...	18 20 37	25 56	254·9	20·81	8·0 ...10·2	8·441	
338	OΣ 351 ...	R. 3923	18 22 11	48 42	29·7	0·63	7·1 ... 7·4	8·408	
339	Σ 2327 ...	Arg. (29°) 3270 ...	18 24 33	29 51	316·0	19·01	7·3 ...11·0	8·441	B = 11 m.
340	OΣ 355 *rej.* ...	L. 34350	18 27 38	8 11	...	...	6·2	8·636	Round.
341	Σ 2344 ...	Arg. (28°) 3027 ...	18 30 19	28 38	180·4	1·58	8·5 ...12·0	8·441	
342	OΣ 357 ...	Arg. (11°) 3518 ...	18 30 21	11 37	258·9	0·52	7–8... 7–8	8·636	
343	Σ 9 App. II...	α Lyræ (Vega) ...	18 32 52	38 40	154·9	48·01	1·0 ...10·5	8·408	A and B.
					154·9	48·11	... ...	8·534	
					289·9	51·66	13–14	8·337	A and C.
					292·9	51·97	... ...	8·395	
					293·1	51·93	... ...	8·408	
344	Σ 2358 ...	... ...	18 34 0	30 37	218·5	2·90	8·8 ... 9·0	8·529	
345	Σ 2384 ...	L. 34968	18 38 33	67 0	...	...	8·0 ... 8·5	8·476	Single.
346	Sh. 277 ...	... ...	18 40 23	39 31	38·4	46·61	... ...	8·337	A and B.
					38·5	46·81	... ...	8·381	
					357·4	24·94	... ...	8·337	C and D.
					354·7	25·09	... ...	8·389	
					247·3	42·57	... ...	8·337	A and C.
347	β 293 ...	β Lyræ	18 45 39	33 13	247·2	46·35	3 ...13	8·337	A and C.
					248·8	46·26	... ...	8·389	
					149·1	45·64	6·7	8·389	A and B.
348	OΣ 364 ...	L. 35242	18 48 24	25 14	...	...	7–8...11	8·411	
349	OΣ 525 ...	Lyræ 91	18 50 28	33 49	124·6	1·56	5·5 ... 9·5	8·408	A and B.
350	OΣ 365 ...	L. 35438	18 52 20	44 4	...	...	... ...	8·408	
351	OΣ 544 ...	γ Lyræ	18 54 27	32 31	300·8	12·80	3·2 ...12·0	8·408	
					301·5	12·72	... ...	8·460	
352	Winlock ...	ζ Sagittarii ...	18 55 0	−30 3	84·2	0·42	3½ ... 4	8·701	
353	Σ 2434 ...	P. XVIII. 274 ...	18 56 34	− 0 53	64·1	1·53	8·4 ...10·3	8·636	B and C.
354	β 287 ...	ζ Aquilæ	18 59 54	13 41	61·0	4·90	3 ...12	8·458	Rather difficult.

No.	Double Star.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
			h m s	° ′	°	″			
					58·0	4·98	... ...	8·512	Windy.
					59·9	4·88		8·636	
355	Σ 2462 ...	... ...	19 3 30	3 12	156·2	8·79	9·5 ... 9·5	8·698	A and B.
					231·6	8·62	12·5	8·698	A and C.
					71·8	5·95	12·5	8·698	B and D.
356	Σ 2464 ...	... ...	19 3 36	11 41	22·2	1·15	8·2 ...10·5	8·636	But little change.
					25·2	1·24	... ...	8·689	
357	H. 879 ...	21 Aquilæ ...	19 7 39	2 5	286·4	36·19	6 ...19	8·449	No measure in H.
358	OΣ 368 ...	W² xix. 279 ...	19 10 37	15 57	220·4	0·93	7·1 ... 8·4	8·636	A and B.
					212·9	1·18	... ...	8·689	Very unsteady.
					215·4	0·99	... ...	8·706	
					98·2	17·37	... ...	8·636	A and C.
359	Σ 2508 ...	... ...	19 14 24	67 39	117·8	17·99	8·7 ... 9·0	8·425	Σ 117°·7 : 17″·65 (1832·4).
360	Σ 2514 ...	... ...	19 16 49	67 28	316·7	8·49	9·0 ...11·3	8 397	
					316·0	8·53	... ...	8·425	
361	Σ 2512 ...	... ...	19 18 5	31 30	310·5	22·33	7·5 ... 9·8	8·471	
362	Σ 2515 ...	... ...	19 19 23	21 17	24·3	13·08	8·0 ... 9·0	8·597	
					23·3	12·89	... ...	8·703	
363	Σ 2536 ...	... ...	19 26 16	17 32	64·5	1·76	8·0 ...11·0	8·698	
364	Σ 2538 ...	... ...	19 27 3	36 27	52·8	5·97	8·3 ... 8·7	8·471	B and C.
					238·5	21·09	13	8·471	A and *c*.
365	Σ 2544 ...	... ...	19 31 19	8 3	238·8	15·63	7·8 ... 8·5	8·616	Too poor for AB.
366	H. 599 ...	54 Sagittarii ...	19 33 52	−16 33	244·5	35·76	5–6...14	8·698	A and B. Mags.
					41·7	45·57	10	8·698	A and C. 5...11·5...9.
367	Σ 2557 ...	... ...	19 34 49	29 28	103·4	10·76	7·3 ... 9·8	8·473	A and B.
					303·4	20·95	11·0	8·473	A and C.
368	Σ 2564 ...	... ...	19 35 49	63 33	175·1	10·04	8·5 ...10·2	8·397	
369	OΣ 380 ...	χ Aquilæ ...	19 36 55	11 33	82·9	...	5·7 ... 7·7	7·681	
					76·6	0·55	... ...	7·684	
					68·2	0·93	... ...	7·725	
					72·9	...	... ...	7·728	
					72·5	0·44	... ...	7·775	
370	OΣ 382 ...	L. 37472	19 37 0	27 6	175·3	0·45	7·0 ... 7·0	8·529	
371	Σ 2574 ...	... ...	19 39 5	62 23	145·0	0·63	8·0 ... 8·0	8·476	
372	A. G. C. 11 ...	P. XIX. 257 ...	19 39 15	10 29	126·1	...	7·5 ... 7·5	7·681	A and B.
					147·4	...	... ...	7·725	
					147·0	0·26	... ...	8·622	
					142·0	0·32	... ...	8·701	
					279·3	...	... ...	7·681	AB and C.
					276·6	4·16	9·5	8·703	
373	OΣ (App.) 190	L. 37628	19 39 50	46 57	300·2	11·64	7·5 ...12–13	8·397	A and B.
					316·8	67·32	9·0	8·397	A and C.

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			h m s	° ′	°	″			
374	... ...	γ Aquilæ ...	19 40 33	10 19	267·8	50·2	3 ...11·0	7·666	A and B.
					30·4	...	... ...	7·666	A and C.
					257·6	...	... ...	7·66	A and D.
375	Σ 2579 ...	δ Cygni	19 41 13	44 50	333·7	1·40	3·0... 7·9	8·647	
					332·6	1·40	... ...	8·649	
376	A. G. C. 12 ...	ζ Sagittæ ...	19 43 39	18 51	158·3	0·22	6 ... 6	7·722	A and B.
					157·6	0·24	... ...	7·728	
					158·1	0·27	... ...	7·775	
					158·7	0·35	... ...	8·636	
					155·4	0·35	... ...	8·701	
377	H. 2904 ...	B.A.C. 6814 ...	19 47 8	−24 14	140·8	18·39	6 ...10	8·706	Mags. 7...10.
378	OΣ 532 ...	β Aquilæ... ...	19 49 25	6 7	18·2	12·01	3·4...11·3	8·597	
					15·2	11·96	... ...	8·622	
					16·1	12·03	... ...	8·625	
379	β 425 ...	L. 38087	19 52 15	19 58	240·2	1·32	8·8... 9·0	8·625	A and B.
					39·3	19·61	12·0	8·625	A and C.
380	A. C. 16 ...	... ...	19 52 57	26 56	237·7	0·45	7½ ... 8	8·678	A and B.
381	OΣ 392 ...	Cygni 116 ...	19 53 54	41 56	317·0	0·31	7·0... 9·0	8·534	A and B.
					289·2	3·32	9·0	8·534	AB and C.
382	Ḥ IV. 100 ...	χ Sagittæ... ...	19 54 38	17 11	205·4	28·96	12	8·698	
383	Σ 2612 ...	... ...	19 55 31	6 36	53·3	38·03	7·8... 8·8	8·458	
384	β 439 ...	... ...	19 55 56	29 30	159·9	1·52	8·0...12·0	8·411	
385	Σ 2615 ...	L. 38279	19 57 5	8 4	319·6	10·51	7·2...10·1	8·458	
					317·2	10·68	... ...	8·625	
386	Σ 2619 ...	... ...	19 57 29	47 56	242·2	4·42	8·1... 8·1	8·397	A and B.
					294·2	18·40	11-12	8·397	A and C.
387	Ḥ V. 147 ...	26 Cygni	19 57 58	49 46	146·8	41·76	5·5... 8·5	8·408	A and B.
					73·7	8·99	11·0	8·408	B and C.
388	β 57	L. 38415	19 59 55	15 9	123·4	2·50	6·2...10·6	7·703	Mags. by De.
389	β 429, 440 ...	L. 38520	20 1 27	35 27	61·1	6·63	7 ...12-13	8·534	A and B.
					25·1	8·39	12	8·534	A and C.
390	Σ 2635 ...	Aquilæ 231 ...	20 4 19	8 6	79·3	7·18	7·0...10·5	8 706	No change.
391	OΣ 400 ...	L. 38758	20 6 14	43 35	...	...	7·3... 7·7	8·647	Single with all powers.
392	Σ 2652 ...	... ...	20 7 3	61 43	269·9	0·42	7·3... 7·6	8·534	Well separated.
393	Σ 50 App. I. .	o^2 Cygni	20 9 51	46 23	173·8	106·63	3·7... 6·5	8·389	A and B.
					321·7	36·82	17	8·389	A and *a*.
					169·6	43·19	... ...	8·389	A and *b*.
					91·7	40·1	... ...	8·389	B and *c*.
					61·8	60·5	... ...	8·389	B and *d*.
					136·0	60·5	... ...	8·389	B and *e*.
394	Σ 2658 ...	... ...	20 10 29	52 45	119·9	5·21	7·0... 9·1	8·649	A and B.
					212·4	40·50	10·2	8·649	A and C.

Last three single distances.

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			h m s	° ′	°	″			
395	A. G. C. 13 ...	a^2 Capricorni ...	20 11 24	−12 55	150·3	7·77	... ...	8·512	A and BC.
					151·4	7·07	... ...	8·534	
					148·8	7·39	... ...	8·589	
					62·6	1·23	12 ...12	8·512	B and C.
					59·8	0·89	... ...	8·534	
396	Σ 2662 ...	... ...	20 12 50	10 37	36·6	1·65	8·2 ...11·0	8·537	
397	... ...	ν Capricorni ...	20 14 0	−13 8	210·1	55·38	... ...	7·775	12–13 m.
398	h N. 138 ...	O¹. Arg. 20475 ...	20 17 42	−17 23	330·6	2·93	... ...	8·722	Mags. 8·0...8·5.
399	β 443 ...	L. 39293	20 19 12	28 37	134·3	12·98	7·5 ...11·5	8·473	A and B. } Another star
					87·4	35·22	12	8·473	A and C. } 25″ *sf.*
400	β 363 ...	Vulpeculæ 93 ...	20 24 28	20 12	62·8	21·77	7 ...12	8·706	
401	β 63... ...	1 Delphini ...	20 24 33	10 30	345·0	1·22	6 ... 8	8·458	Unsteady. C not seen. Distance too large.
402	Σ 2690 ...	P. XX. 178 ...	20 25 29	10 51	108·5	23·65	7 ...16	7·807	A and D.
					108·4	23·16	... ...	8·722	
403	Ma. 8 ...	W¹ xx. 688 ...	20 28 15	11 41	248·1	19·29	8·5 ...11·0	7·807	
					248·7	18·98	... ...	8·722	
404	Σ 2703 ...	... ...	20 31 13	14 19	290·3	24·96	7·6 ... 7·6	8·722	A and B.
					217·1	57·78	7·6	8·722	B and C.
					238·1	...	... ...	8·722	A and C.
405	β 151 ...	β Delphini ...	20 31 55	14 11	45·6	0·38	... ...	7·760	A and B.
					35·0	...	... ...	7·775	
					41·2	0·26	... ...	7·818	
					41·3	...	... ...	7·829	Est. 0″·25.
					52·3	0·22	... ...	8·622	
					52·2	0·28	... ...	8·633	
					52·1	0·20	... ...	8·636	
					58·4	0·27	... ...	8·701	
					117·2	27·74	... ...	7·701	A and C.
					115·7	27·86	... ...	7·821	
					115·7	27·37	... ...	8·625	
					335·6	35·06	... ...	7·701	A and D.
406	OΣ 533 ...	κ Delphini ...	20 33 17	9 40	329·8	10·70	4·8 ...11·4	7·725	
					329·1	10·43	... ...	7·807	
					329·3	10·43	... ...	8·468	
					328·5	10·82	... ...	8·722	
407	H. 1554 ...	α Delphini ...	20 34 3	15 29	279·7	42·02	5–6...13	7·821	A and C.
					279·9	42·47	... ...	8·722	
					330 2	47·96	13	7 821	A and D.
					114·1	...	... ...	7 821	A and E.
408	β 288 ...	Delphini 32 ...	20 34 31	15 25	167·8	7·87	7 ...13–14	8·537	Difficult.

No.	Double Star.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
			h m s	° ′	°	″			
409	Σ 2714 ...	... ...	20 35 17	29 20	341·9	6·87	8·5 ...12·0	8·436	Not good.
410	β 267 ...	... ...	20 35 25	− 4 50	151·9	2·11	9·0 ... 9·0	8·678	No other measures.
411	Σ 2720 ...	... ...	20 37 56	16 31	182·1	4·07	8·5 ... 8·7	8·698	
412	Σ 2723 ...	Delphini 43 ...	20 39 11	11 53	33·6	38·7	6·4 ...12	7·701	A and C.
413	β 152 ...	Cephei 55 ...	20 39 18	56 57	112·3	0·55	7·0 ... 9·0	8·534	
414	OΣ 413 ...	λ Cygni	20 42 44	36 3	85·3	0·74	5·5 ... 7·6	8·529	
415	Σ 2734 ...	... ...	20 48 21	12 39	191·3	25·66	8·2 ... 8·7	8·537	
					191·0	25·81	... ...	8·597	
					191·4	26·00	... ...	8·698	
416	OΣ 418 ...	L. 40485 ...	20 49 54	32 15	294·8	1·2 ±	7·3 ... 7·3	7·769	
417	OΣ 419 ...	W² xx. 1574 ...	20 50 1	36 37	38·0	1·65	7·3 ...10·3	7·758	
418	OΣ 424 ...	L. 40628 ...	20 53 39	15 6	327·6	0·45	7–8... 8–9	8·594	A and B.
					327·9	0·45	... ...	8·678	
					306·3	...	... ...	8·594	A and C.
419	H. 3006 ...	... ...	20 54 52	2 28	112·1	1·94	10 ...10	7·818	
					110·0	1·69	10 ...19	8·537	
420	ℍ IV. 113 ...	B.A.C. 7313 ...	20 57 45	39 2	299·9	18·72	6 ...10	8·471	A and B.
					250·0	25·80	12	8·471	A and C.
421	Σ 2749 ...	... ...	20 58 43	3 3	147·3	0·99	9·5 ... 9·5	7·766	B and C.
					150·5	1·26	... ...	7·818	
422	Σ 2752 ...	Aquarii 43 ...	21 0 29	−14 24	151·9	5·60	6·7 ...10·7	8·589	A and B.
					83·7	20·99	12	8·589	A and C. AC = β 157.
423	527 ...	W¹ xx. 1550 ...	21 2 1	4 40	279·4	0·64	7·2 ... 7·2	7·760	The *p.* star ½ mag. smallest.
					285·6	0·44	... ...	8·636	
					290·1	0·49	... ...	8·678	Mags. 7·7...8·3.
424	Star and Neb.	... ...	21 2 14	47 22	243·1	26·63	... ...	8·468	* and neb.
					245·0	28·05	... ...	8·476	
					85·5	2·57	... ...	8·476	Distance of nuclei.
425	OΣ 429 *rej.*...	L. 41005	21 3 22	4 33	...	...	... ...	8·678	Certainly single.
426	Σ 2763 ...	... ...	21 3 52	16 51	295·4	17·60	8·5 ... 9·7	8·395	
					292·8	17·30	... ...	8·625	
427	Kn. 2 ...	γ Equulei ...	21 4 30	9 39	274·5	2·16	4·2 ...11·0	7·728	A and B.
					10·0	41·34	12	7·728	A and C.
428	β 270 ...	Equulei 19 ...	21 7 31	6 43	347·4	1·26	7 ... 9	7·725	A and B. A faint star at 32°·4.
					172·6	183·40	7	7·725	A and C. AC = S. 781.
429	OΣ 535 ...	δ Equulei ...	21 8 38	9 31	156·4	0·2 ±	4·5 ... 5·0	7·760	Slight elongation.
								8·633	No certain elongation.
								8·678	Perhaps elongated in 180°, but doubtful.
430	A. G. C. 13...	τ Cygni	21 10 0	37 32	150·0	1·06	4·9 ... 7·4	8·408	Mags. by De.
431	OΣ 433 ...	υ Cygni	21 12 58	34 23	218·5	14·77	4·5 ...10·3	8·436	A and B.
					177 9	21·38	10·2	8·436	A and C.

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			h m s	° ′	°	″			
432	β 289 ...	W² xxi. 289 ...	21 13 22	34 25	137·8	0·90	8·2 ...10·0	8·529	A and B.
					262·1	5·39	13	8·529	A and C.
433	OΣ 435 ...	L. 41486	21 15 19	2 23	205 9	0 62	7·5 ... 7·8	8·678	
434	H. 3023 ...	β Equulei ...	21 16 56	6 18	260·1	32 09	5 ...13–14	7·776	A and B.
					259·3	31·07	... ...	8·633	
					308·7	67·4	... ...	7·776	A and C. Single distances.
					10·4	6·03	14 ...15	7·728	C and D.
					275·9	86·28	15	8·633	A and E,
435	H. 5517 ...	18 Aquarii ...	21 17 37	−13 23	325·7	47·84	6 ...	7·824	Very faint.
436	β 447 ...	Vulpeculæ 129 ...	21 18 45	24 48	329 7	8·59	6·5 ...13	7·802	No other measures.
					331·1	8·45	6 ...12–13	8·625	
437	β 164 ...	L. 41645	21 19 13	8 52	237·3	0·82	8 ... 8½	7·725	(AC = Σ 2793).
438	β 72 ...	W¹ xxi. 511 ...	21 23 43	− 5 55	42·8	1·89	9 ...11	7·722	In the field with β 684.
					43·4	1·90	... ...	8·622	
439	H. 936 ...	β Aquarii ...	21 25 14	− 6 6	320·0	34·26	3 ...15	7·701	AB.
					185·6	55 04	12	7·701	AC.
440	β 273 ...	W¹ xxi. 646 ...	21 28 33	10 55	93·3	5·63	8 ...12	7·821	
441	H. 3040 ...	ε Capricorni ...	21 30 22	−20 0	46·8	67·94	5 ... 9	7·824	Faint star, 156° : 70″.
442	H. 941 ...	4 Pegasi	21 32 31	5 14	344·9	25·95	6–7...17	8 706	No measures by H.
443	Σ 2822 ...	μ Cygni	21 38 46	28 12	115·3	3·92	4 ... 5	8·408	A and B.
					117·2	3 84	... ...	8·436	
					262·7	35·40	12	7·717	A and C.
					263·0	35·16	... ...	8·408	
					56·3	208·52	7	8·436	A and D.
444	H. 1691 ...	L. 42489	21 42 15	− 6 48	276·8	14·68	9 ...13	7·807	A about 8 m. H. 275°·5 : 10″ ± .
445	H. 947 ...	P. XXI. 312 ...	21 45 57	19 16	92·7	20·71	7 ...15	8·395	A and B.
					324·0	24·40	17	8·395	A and C.
446	Σ 2833 ...	... ...	21 46 2	8 31	339·2	9·27	7·2 ...10·0	8·689	
447	Σ 2845 ...	... ...	21 48 59	62 32	173·2	1·86	8·2 ... 8·3	8·425	
448	H 3069 ...	... ...	21 50 31	6 40	78·8	24·98	8 ...12	7·802	AB and C.
449	OΣ 537 ...	O². Arg. 23107 ...	21 52 10	59 16	202·5	2·21	8 ...10–11	8·649	
					200·6	2·12	... ...	8·657	
450	OΣ 458 ...	R. 5483	21 52 40	59 13	349·8	1·00	6·0 ... 8·3	8·649	A and B.
					354·1	0·72	... ...	8·660	
					32·9	22·71	12·5	8·649	A and C.
451	Howe ...	L. 42909	21 55 0	−16 11	270·5	8·94	6½ ...11	8·633	A and B.
					292·3	...	9	8·633	A and C.
452	H. 289 ...	20 Pegasi ...	21 55 14	12 33	326·1	51·28	5–6...12	7·780	(= H. 5525).
453	S. 802 ...	29 Aquarii ...	21 55 51	−17 33	242·4	4·10	8 ... 8½	7·701	
454	Σ 2860 ...	... ...	21 59 26	60 16	256·1	6·13	7·7 ... 9·3	8·425	
					255·2	5·80	... ...	8 668	

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			h m s	° ′	°	″			
455	OΣ 460 ...	Lam. 8679 ...	21 59 32	1 12	46·3	16·04	11·5	7·802	A and C.
					351·8	6·71	7·5 ...12·0	7·802	A and B.
456	β 474 ...	O². Arg. 23373 ...	22 1 2	60 25	345·6	16·28	8 ...12	8 668	
457	OΣ 462 ...	L. 43165	22 1 48	35 31	31·0	6·95	7·5 ... 9·5	7·780	A and C.
458	... ...	π¹ Pegasi... ...	22 3 54	32 35	284·4	27·40	5 ...12	7·780	A and B.
					261·7	72·62	10	7·780	A and C.
459	Σ 2869 ...	Pegasi 129 ...	22 4 32	14 2	253·1	21·23	5·8 ...11·8	7·780	
					253·6	21·53	... ...	8·698	
					253·4	21·82	... ...	8·722	
460	Σ 2879 ...	... ...	22 7 18	62 48	228·3	0·91	8·0 ... 8·0	8·660	
461	Σ 2877 ...	P XXII. 33 ...	22 8 33	16 36	351·9	10·51	6·4 ... 9·6	8·622	Proper motion.
462	β 378 ...	O². Arg. 23808 ...	22 12 50	60 16	90·4	3·33	8·2 ... 8·5	8·649	A and B.
					29·4	7·48	11·8	8·649	A and C.
463	H 962 ...	30 Pegasi... ...	22 14 25	5 11	18·6	6·22	5 ...20	8·594	A and B.
					223·0	10·04	19	8·594	A and C.
464	H 3106 ...	γ Aquarii ...	22 15 27	− 1 59	129·6	43·87	4–5...13	8·722	
465	β 172 ...	51 Aquarii ...	22 17 52	− 5 27	25·4	0·59	6·5 ... 6·5	7·695	
					24·9	0·35	... ...	7·829	
					25·5	0·56	... ...	8·612	
					23·8	0·84	... ...	8·636	Distance too large.
466	β 290 ...	34 Pegasi... ...	22 20 30	3 47	214·4	2·62	6 ...13	7·695	
					220·0	2·56	... ...	7·717	
					221·0	2·41	... ...	7·818	
					219·0	2·89	... ...	8·636	
467	β 291 ...	W¹ xxii. 436 ...	22 21 39	3 55	160·0	0·42	8·5 ... 8·8	8·636	
468	β 478 ...	Lam. 4578 ...	22 23 8	− 7 56	32·6	1·26	9 ...11	7·802	A and B.
					32·7	1·38	... ...	8·594	
					239·0	28·55	9	7·802	A and C.
469	OΣ 471 *rej.*...	Arg. (6°) 5027 ...	22 23 14	7 0	...	...	7	8·636	Single.
470	Σ 2912 ...	37 Pegasi... ...	22 23 54	3 49	130·0	0·32	5·8 ... 7·2	8·636	Very difficult.
471	Σ 2915 ...	W¹ xxii. 527 ...	22 26 33	6 48	155·6	12·40	8·5 ... 8·7	7·804	
					154·6	12·18	... ...	7·829	
472	H. 3128 ...	L. 44290	22 33 34	−19 49	226·2	10·70	8 ...12	7·701	No change in P.
473	Σ 2936 ...	Aquarii 215 ...	22 36 50	0 35	50·8	4·92	7·0 ...10·0	7·829	
474	β 176 ...	Arg. (38°) 4848...	22 37 5	38 40	42·0	2·50	8·7 ... 9·0	7·785	Distance too large.
475	OΣ 477 ...	L. 44497 ...	22 38 13	45 24	154·1	4·62	7·0 ...11·2	8·641	Unsteady.
476	Σ 2942 ...	B.A.C. 7931 ...	22 38 40	38 50	279·4	2 64	7·0 ... 9·2	8·473	A and B.
					231·9	10·92	12	7·785	A and C.
					233·0	10·95	... ...	8·473	AC = β 450.
477	H. 301 ...	ξ Pegasi	22 40 42	11 33	112·0	11·99	5 ...18	8·622	
					111·4	11·87	... ...	8·625	

No.	Double Star.	Star Catalogue.	R.A. 1880.	Decl. 1880.	Position Angle.	Distance.	Mags.	Epoch 1870+	Notes.
			h m s	° ′	°	″			
478	Σ 2944 ...	P. XXII. 219 ...	22 41 40	− 4 51	252·8	3·88	7·0 ... 7·5	7·873	A and B.
					140·8	48·65	8·2	7 873	A and C.
479	H. 3152 ...	L. 44810	22 48 40	−10 1	...	...	9 ...15	8·633	
480	Σ 2954 ...	... ...	22 48 51	14 33	27·4	37·97	9·0 ... 9·0	7·804	
481	β 383 ...	L. 44855	22 49 57	8 49	119·6	2·67	8 ...11	7·818	A and B.
					240 5	15·25	11	7 804	A and C.
					240·1	15·93	... ...	7·818	
482	Σ 2959 ...	L. 44872 ...	22 50 55	− 3 53	102·2	13·65	6·5 ...10·5	7·804	A and B.
					102·2	13·90	... ...	7·947	
					95·9	8·31	12–13	7·947	B and C.
483	OΣ 536 ...	B.A.C. 8001 ...	22 52 29	8 43	161·5	0·47	7 ... 7–8	7·760	
484	β 481 ...	W¹ xxii. 1162 ...	22 56 23	−11 53	53·0	1·31	9·0 ... 9·5	7·760	Near Σ 2970.
					50·7	1·29	... ...	8·622	
485	Σ 2976 ...	... ...	23 1 38	5 57	263·7	8·00	8·3 ...10·2	7·804	A and B.
					263·0	7·77	... ...	8·625	
					188·7	16·74	8·8	7·804	A and C.
					187·9	16·59	... ...	8·625	
486	Σ 2980 ...	... ...	23 2 58	− 7 58	111 8	4·38	7·2 ...10·2	7·758	
487	Σ 2982 ...	57 Pegasi... ...	23 3 28	8 2	199·2	32·48	5·9 ...10·5	7·780	No change.
488	OΣ 489 ...	π Cephei... ..	23 4 5	74 44	23·8	1·28	4·4 ... 7·5	8·660	Binary.
489	Σ 2987 ...	... ...	23 4 49	48 22	164·4	3·68	7·3 ...10·2	8·471	Fixed.
490	β 181 ...	Aquarii 286 ...	23 7 31	−14 3	234·9	18·78	7 ...12	7·736	A and C.
491	Σ 12 App. II.	ψ¹ Aquarii ...	23 9 35	− 9 44	34·9	18·4	... ...	7·695	B and
					275·0	63·0	... ...	7·695	A and D.
492	β 80... ...	L. 40638	23 12 42	4 45	305·1	1·40	8–9...11	7·766	
					307·1	1·09	... ...	7·818	
493	H. 5394 ...	96 Aquarii ...	23 13 10	− 5 47	23·1	10·08	6 ...14	8·622	
494	S. 830 ...	κ Piscium ...	23 20 46	0 36	344·7	156·22	5 ...12	7·780	A minute star between.
495	H. 316 ...	Aquarii 355 ...	23 31 27	−13 44	92·7	33·22	7 ...11	7·829	H. 91°·9 : 30″ ±
496	A. G. C. 14...	78 Pegasi ...	23 37 57	28 42	190·8	1·54	5·0 ... 8·1	8·769	Mags. by De.
					192·8	1·69	... ...	8·775	
497	Σ 3036 ...	P. XXIII. 179 ...	23 39 52	− 0 24	227·9	2·38	7·8 ...10 8	7·859	Fixed.
498	OΣ 506 *rej.* ...	L. 46645	23 42 32	35 37	79·4	18·09	7·0 ...10·3	7·802	
499	OΣ 509 ...	L. 46703	23 44 30	42 45	106·6	5·55	7·8 ... 9·2	7·785	Fixed.
500	Σ 3046 ...	... ...	23 50 15	−10 10	244·8	3·05	8·0 ... 8·5	7 942	Slow motion.
501	β 281 ...	L. 47148	23 56 38	1 28	214·0	1·19	7·5 ...11	7·717	A and B.
					220·1	1·05	... ...	7·942	
					335·7	30·37	11	7·717	A and C.
					336 0	30·51	... ...	7·942	
502	Σ 3055 ...	... ...	23 57 51	11 29	359·6	5·79	7·0 ...11·2	8 625	

Notes to the Micrometrical Measures.

No. 1. Σ 3063.

The following are all the measures of this pair:—

	°	″	
Σ	P = 232·9	D = 1·78	1831·5
DE.	223·7	1·85	1864·8
β	223·3	1·82	1877·9.

No. 2. H. 1939.

The only earlier observation is by H.:—

	°	″
H.	P = 158·3	D = 30±

There would seem to be no change in the direction. HERSCHEL'S declination is 5′ in error.

No. 3.

From an unpublished list of double stars from Professor PICKERING, Director of Harvard College Observatory. There are no other measures.

No. 4. Σ 14.

There is but little, if any, change in this pair:—

	°	″	
Σ	P = 235·6	D = 15·19	1830·9
DE.	236·4	14·27	1864·8
β	236·3	14·38	1877·9.

No. 5. Σ 15.

This pair was measured because of the smaller angle found by Se. My measures do not confirm the change there indicated:—

	°	″	
Σ	P = 197·9	D = 4·70	1831·2
Se.	191·7	4·57	1857·9
β	197·2	4·61	1877·9.

No. 6. OΣ 4.

Undoubtedly a binary system.

	°	″	
OΣ	P = 206·7	D = 0·59	1845·3
OΣ	187·6	0·55	1854·0
OΣ	172·7	0·56	1861·7
De.	184·7	obl.	1865·0
β	155·3	0·56	1878·6.

The distance appears to remain nearly constant.

No. 11. Σ 35.

Probably fixed, unless there be a slight retrograde motion. The following are all the measures:—

	°		
Σ	P = 268·3	D = 8·69	1830·2
De.	87·4	7·93	1866·8
β	266·6	8·62	1877·9.

No. 12. De. 2.

As a wide pair, this is Σ 39. The large star was discovered by De., in 1867, to be a close pair, and independently detected by Se. There is no change in the distant star, and no other recent measures of AB.

	°	″	
Se.	P = 237·0	D = 0·4	1858·0
De.	243·1	obl.	1867·6
β	241·8	0·89	1877·8.

No. 13. α *Cassiopeiæ.*

The larger companion, C, makes the double star, ℍ V. 18 = SH. 5 = H. 1993. No measures of distance in SH. That in SMYTH'S *Cycle* is entirely wrong:—

	°	″	
ℍ	P = 275·4	D = 54·49	1782·0
P.	279·8	61·19	1854·8
β	279·8	62·51	1878·6.

There appears to be a slow increase in the distance. This star is much brighter than H.'s 14 m. SM. called it 10½, and PIAZZI, 9 m. The new star, B, is excessively faint.

No. 14. Σ 49.

Probably a small increase in the distance.

	°	″	
Σ	P = 321·5	D = 4·49	1830·9
DE.	319·7	5·24	1865·2
β	320·8	5·68	1877·9.

No. 15. OΣ 18.

Direct angular motion is obvious from the following:—

	°	″	
MA.	P = 90·6	D = 1·02	1843·9
OΣ	94·7	1·34	1855·2
SE.	99·8	1·13	1858·5
DE.	106·2	1·55	1866·6
β	116·1	1·39	1877·9.

No. 21 μ *Andromedæ.* (AC = H. 1057.)

The only apparently accurate observation of distance is that of CHALLIS, given by SM. in the *Cycle*:—

°	″	
P = 110·5	D = 49·19	1842·7.

The nearer star, B, is very much fainter than H.'s companion.

No. 22. Σ 76.

But little evidence of change. With the exception of a single observation by MA., the following are all the measures:—

Σ	P = 198°·1	D = 2″·72	1830·5
β	200·1	2·84	1877·9.

No. 25. 72 *Piscium*.

I have seen the companion very fairly with the 6-inch refractor. The only other measure is H., P = 265°·6 : D = 30″±.

No. 26. φ *Andromedæ*. OΣ 515.

The only other measures of this difficult and interesting system are found in the *Pulkowa Observations*. DE. found it single in 1865 and 1867. The following are the mean results of OΣ:—

OΣ	P = 309°·9	D = 0″·53	1851·5
OΣ	303·9	0·51	1856·9
OΣ	302·6	0·56	1864·7
OΣ	267·2	obl.	1875·1
β	273·0	0·2	1877·7
β	272·3	0·28	1878·8.

The last measure made after the foregoing was in type.

No. 27. β 235.

The three wide stars, A, B, and C, with the companion to the latter, make OΣ 24. In 1874 the large star, A, was found with the 6-inch to be composed of two nearly equal stars, and a minute attendant to B detected. There seems to be no change in the old members of the system. My distance of the close pair is certainly too large. By a mean of six observations by DE. we have :—

DE.	P = 74°·0	D = 0″·45	1875·6.

For the other components the same observer finds :—

C and c	P = 48°·9	D = 8″·00	1868·0
A and B	287·9	43·81	1868·7
A and C	66·9	60·86	1868·0.

No. 28. Σ 95 = H. 324.

De. failed to see the companion in 1864–5, as I did in 1873. In 1874 the 6-inch showed at once the small star. There is no indication of motion.

Σ	P = 310°9	D = 14″05	1829·9
β	309·6	14·18	1877·8.

No. 29. OΣ 28.

Angular motion is probable.

OΣ	P = 324°4	D = 0″53	1847·6
De.	314·7	0·92	1867·4
β	314·0	0·85	1878·7.

No. 30. H. 1076.

No observations since H., who gives:—

A and B	P = 165°9	D = 4″±
A and C	258·0	25″±

The distances are largely under-estimated. H. notes it "difficult," and I found B very faint.

No. 31. *Polaris.*

Some three years ago the discovery by M. De Böe, of Belgium, of two small companions about 4″ distant was announced, and several observers subsequently claimed to have seen them in the described places. The alleged discovery and verifications were made with small apertures, not much exceeding in any instance 6 inches. After having failed with my 6-inch Clark refractor to see the least trace of any star nearer than the old companion, I had very little expectation of seeing them with any aperture. *Polaris* was examined once or twice previous to the occasion noted in the measures, but the conditions were not particularly favourable. At this time the air was very steady and transparent, allowing the use of the highest

powers. There was not the slightest suspicion of any star within the distance of the well-known companion, and I have no hesitation in saying these supposed new stars do not exist. It would be simply impossible to overlook anything of that description under the circumstances.

No. 35. OΣ 30.

There is probably no change in the relations of the nearer components. I noticed another very minute companion to B, 154°·0 : 20·″±.

OΣ	P = 235·7	D = 4·62	1855·7
De.	240·5	3·82	1866·6
β	238·9	4·55	1877·7.

No. 36. Σ 132 = ♅ IV. 130.

The great change in this pair is due to proper motion. Some of the measures are:—

♅	P = 27·7	D = 15·82	1783·6
Σ	5·4	24·25	1829·9
De.	356·2	30·99	1863·8
β	354·6	33·86	1878·0.

No. 37. OΣ 32.

The companion, which is faint with moderate apertures, was not seen by De. The large star at one time was suspected to be a close pair. On both occasions I found it apparently round. The following single observation by OΣ is all there is for comparison:—

OΣ	P = 135·4	D = 9·51	1847·2
β	134·0	8·92	1878·7.

No. 38. Σ 145.

Very little attention has been given to this pair since Σ. It has been overlooked by all but Ma. There is probably no change.

Σ	P = 31·6	D = 11·28	1832·8.

No. 39. Σ 196.

The following are the principal measures of this pair:—

Σ	P = 55°·5	D = 2″·37	1832·4
De.	57·3	2·17	1866·8
β	52·0	2·49	1877·7.

No. 40. ε *Trianguli.* Σ 201.

This fine pair has been wholly neglected by recent observers. Change is not very decided.

Σ	P = 119°·6	D = 3″·72	1833·1
β	116·8	4·10	1877·8.

No. 42. 61 *Ceti.* ℍ V. 102.

It is evident that one of the distances of ℍ must be in error. I do not find any other measures except the reference in Sm.:—

ℍ	P = 190°±	D = 34″·50	1783·2
ℍ	193·7	37·88	1783·6
β	193·3	42·71	1877·9.

No. 43. Σ 223.

There is but little evidence of change in the two observations since Σ.

Σ	P = 48°·3	D = 0″·65	1831·0
OΣ	51·9	0·83	1847·0
β	50·7	0·78	1878·7.

No. 46. ο *Ceti.* (Mira.)

The nearer star, B, between A and C has not before been observed. There is but little change in ℍ's companion.

ℍ	P = 92°·5	D = 114″·60	1782·6
P.	84·9	117·9	1856·1
β	82·8	115·62	1877·8.

The new companion is very faint.

No. 48. 84 *Ceti.* Σ 295.

There is certainly some change in angle, but the distance remains nearly constant. Some of the measures are:—

	°	″	
Σ	P = 334·6	D = 4·85	1831·9
De.	324·7	4·63	1864·0
β	324·3	4·73	1877·9.

No. 49. Σ 293.

Motion in angle and distance is clearly shown. The following are all the measures:—

	°	″	
Σ	P = 57·5	D = 6·61	1830·9
Ma.	68·6	...	1852·6
De.	71·2	7·67	1866·1
Gl.	71·0	7·7	1874·0
β	75·3	8·30	1878·6.

De. in 1867·6 found the companion invisible. The change is probably due to proper motion.

No. 50. Σ 303.

Attention was called to this pair from the change shown by the measures of Se. It is not confirmed by my observation :—

	°	″	
Σ	P = 180·6	D = 5·65	1831·2
Se.	176·9	5·54	1858·5
β	181·9	5·87	1877·8.

No. 52. *η Persei.*

There are several distant companions to this well-known pair, one of which was found to be double by Mr. I. W. Ward, of Belfast, with an aperture of only 4·2 inches. Most observers will require a larger instrument to even glimpse it. There is a 13 m. star about 20″ from C in the direction of 228°·2.

No. 53. Σ 310.

H. in 1827 noted this pair as "not seen double." There are no other measures since Σ, and no evidence of change:—

Σ	P = 86°·3	D = 2″·54	1832·1
β	87·6	2·62	1877·9.

A new pair in the field will be found in the list of new stars (No. 523).

No. 54. OΣ 46 = H. 656.

This star has a closer component, DE. 73°·9 : 4″·80 (1869·9), not mentioned in H. 656, and the star measured, which makes H.'s pair, was not seen by OΣ. The angle was not measured by H.

No. 55. *τ Persei.*

My attention was called by Mr. D. W. EDGECOMB to the small star, B, in measuring which a still fainter attendant was detected near B. On this occasion it was too difficult to attempt measures of distance.

No. 56. Σ 330.

The only measure since Σ makes the distance decidedly less. The recent measures do not substantiate any change in distance or angle:—

Σ	P = 191°·1	D = 8″·78	1832·7
MA.	192·4	7·66	1844·0
β	191·5	8·69	1877·9.

No. 57. Σ 332.

It seemed probable that there was an error of 20° in the angle of MA., and my observation confirms this supposition. There are no other measures recorded since those of Σ:—

Σ	P = 52°·9	D = 12″·68	1831·4
MA.	33·2	12·0	1844·1
β	53·4	12·52	1877·9.

No. 59. Σ 355.

Change is at least doubtful.

	°	″	
Σ	P = 148·9	D = 2·75	1832·5
SE.	142·6	2·65	1857·1
β	147·8	2·64	1877·9.

No. 61. Σ 358.

This pair has been entirely neglected of late years. The components are probably relatively fixed:—

	°	″	
Σ	P = 349·2	D = 15·22	1833·1
β	350·3	15·59	1877·9.

No. 63. 94 *Ceti*. H. 663.

This fine unequal pair, from its difficulty or some other reason, has been avoided by all previous observers, except DE. I have seen the companion with the 6-inch several times, but it is a rather severe test. H. only estimated the angle and distance. DE. calls the small star 11·5 m. and notes it, "very difficult." Giving the estimates of H. their usual accuracy, there is no great amount of motion:—

	°	″	
H.	P = 255±	D = 6·±	
DE.	253·1	5·09	1871·0
β	250·9	5·73	1878·0.

No. 66. *Tauri* 39. Σ 430.

A and B are relatively fixed, but the distance of C is less than found by Σ. There are no other measures:—

	°	″	
Σ	P = 301·9	D = 39·40	1831·2
DE.	301·0	37·76	1863·1
β	301·0	37·74	1878·0.

Is Σ's distance a misprint for 37″·40?

No. 68. OΣ 61 *rej.*

An elongation of this star was suspected by OΣ in 1842, and a 10 m. star at 1″·2 suspected in 1844; but it was rejected in the revised Pulkowa Catalogue of 1850. It was readily seen and measured by DE., and OΣ suggests a possible variability in the light of the small star. I found it as described by DE. The following are all the measures:—

	°	″	
DE.	P = 125·9	D = 1·93	1867·0
β	127·8	1·87	1877·9.

No. 69. Σ 449.

As the only measure of this pair made since Σ showed some variation, it was measured by me on two occasions. There is but little evidence of change:—

	°	″	
Σ	P = 330·9	D = 6·79	1832·2
MA.	326·8	6·0	1843·1
β	330·8	6·94	1877·9.

No. 70. *Atlas Pleiadum.* Σ 453.

The observations of Σ show this star to have been a very close pair in 1830. All observers since, including DA., DE., SE., and many others, have invariably found it single. I have examined this star many times in the last five years, with the 6-inch, under very favourable circumstances, and always found it perfectly round. With the 18½-inch, on this occasion and at other times, it presented the same appearance. The observations of Σ made the change quite rapid, and if really double, it must have been apparent at some time during the last fifty years. From all the evidence, I think it is more than probable that the elongation measured by Σ was not real.

No. 71. 30 *Eridani.* H. 338.

DE. suspected an elongation of the principal star in 165°, but I found it apparently round. H. called the small star 17 m., WN. 9–10, and DE. 10·5. I always found it very easy with the 6-inch. Not measured by H., and the following are all the measures since:—

	°	′	
WN.	P = 136·8	D = 8·28	1863·8
DE.	135·2	8·17	1864·4
β	135·3	8·34	1878·0.

No. 72. Σ 475.

No other measures since Σ. Some change in angle is probable.

	°	″	
Σ	P = 15·9	D = 7·48	1831·0
β	22·5	7·34	1877·9.

No. 74. OΣ 531.

According to OΣ this star has the same considerable proper motion as 50 *Persei*, 12′ distant. Relative motion in the components seems well established. I found a new pair in the field, closer and much more difficult. It is No. 545 of the preceding list of new pairs. The following are all the measures of OΣ 531:—

	°	″	
OΣ	P = 147·9	D = 3·30	1855·5
De.	139·3	2·75	1875·9
β	138·5	2·60	1878·6.

No. 77. μ *Persei*. OΣ 73.

There is a distant star, *sp.*, which makes ♅ VI. 20 and Sh. 364. A faint star *sf.* is nearer than this. The closer component is very minute, and was not seen by De. The only measures for comparison are:—

	°	″	
OΣ	P = 349·2	D = 15·07	1851·1
β	348·6	14·88	1878·1.

No. 78. OΣ 77.

This is undoubtedly a binary system, but at all times so difficult that the measures are rare. The following are all the measures:—

	°	″	
OΣ	P = 338·2	D = 0·37	1846·1
Ma.	330·1	0·35	1846·1
Ma.	337·3	0·3	1852·2
Se.	250°±	Allung.	1859·0
De.	Pas du tout mesurable		1867·
β	249·3	0·44	1878·5.

The distant companion (OΣ 41°·7 : 56″·49; 1847·2) I strongly suspected, on the occasion of the first measure of AB, to have an excessively minute star about 0″·7 distant in the *sp.* quadrant. I was not able to see it afterwards, under tolerably favourable conditions, when the close pair was well separated, but nevertheless I believe it exists, and that it will be yet seen.

No. 79. 40 *Eridani.* Σ 518.

One of the most interesting of the stellar systems, from the large proper motion, and the physical relation of the distant double companion with the principal star. Like many others, this has been neglected by double star observers until recently. My last measures were made after this work was in type. The following are about all the measures of A and B:—

	P	D	
ℍ	326·7	4·08	1783·1
Σ	287·7	...	1825·1
OΣ	155·8	3·91	1851·2
OΣ and WN.	144·7	4·38	1866·1
OΣ	137·0	4·27	1873·8
DE	127·0	4·27	1877·7
β	128·2	3·92	1877·8
O.S.	129·2	3·61	1877·8
β	125·4	3·66	1879·0.

The distant star I have measured does not partake of the proper motion of A. The only measures are :—

	P	D	
WN.	185·0	75·85	1864·8
FLM.	148·0	37·2	1877·1
β	145·6	37·10	1877·8
β	137·3	35·99	1879·0.

No. 82. Σ 547.

This pair has not been measured or seen by anyone since Σ. DE. failed to see the companion in 1865, and it was invisible with the 6-inch in 1873, 1876, and early in 1877. The change is very decided. The last is a mean of four later measures:—

	P	D	
Σ	344·3	4·25	1831·4
β	9·8	2·46	1877·9
β	14·0	2·25	1879·0.

No. 83. 80 *Tauri.* Σ 554.

For several years this has been a very difficult pair, and generally too severe a test for the 6-inch. The change is principally in distance. There are no other recent measures:—

	°	″	
Σ	P = 12·9	D = 1·74	1831·2
OΣ	8·4	1·61	1851·8
De.	7·2	1·23	1863·0
Hd.	4·7	0·75	1868·1
β	7·0	0·60	1878·0.

Undoubtedly a physical pair, as the two components have a considerable common proper motion.

No. 84. Σ 571 = ♅ III. 95 = H. 345.

Probably unchanged. Apparently an error of 10° in angle of Se. There is a faint distant star, 200°·3 : 46″·6 (1878·0):—

	°	″	
♅	P = 260·7	D = 15·35	1783·7
Σ	258·7	17·84	1830·7
Se.	268·9	17·54	1858·0
β	258·2	17·30	1878·0.

No. 85. Σ 596.

The measures indicate a slow direct motion.

	°	″	
Σ	P = 280·8	D = 11·12	1831·1
De.	284·3	10·28	1865·7
Gl.	283·5	10·4	1874·0
β	287·3	10·75	1878·0.

No. 86. Σ 609 = H. 686.

De. found it single in 1865, and I failed to see it with the 6-inch, under excellent conditions, in 1874. On a later occasion, however, it was very plain. There is only my observation to compare with Σ:—

	°		
Σ	P = 82·1	D = 1·93	1832·1
β	75·6	2·70	1878·1.

No. 87. Σ 607.

De. in 1866 notes, "Aucun satellite supérieur à 11·5," and I could not glimpse it with the 6-inch in 1873. The stars seem to be relatively fixed.

Σ	P = 249·9	D = 14·21	1831·1
H.	248·0		(6th Catalogue.)
β	250·3	14·12	1877·9.

No. 89. 5 *Aurigæ*. OΣ 92.

Probably a binary system.

Da.	P = 233·3	D = 2·92	1847·1
OΣ	230·1	2·78	1849·1
De.	241·3	2·82	1867·4
β	247·4	2·78	1878·0.

No. 91. OΣ 100 = H. 693.

The change, if any, is slight. This pair was not measured by H.:—

OΣ	P = 247·2	D = 4·32	1848·5
De.	249·8	4·09	1867·4
OΣ	253·3	4·26	1871·2
β	248·8	3·80	1878·1.

No. 92. OΣ 517.

A minute star discovered by Professor Hall with the Washington 26-inch. The only measure to compare with is:—

Hl.	P = 131·6	D = 6·70	1876·1.

The large star is a close pair (OΣ 517), but seeing too poor on this occasion to measure it.

No. 93. α *Aurigæ*. (H VI. 30 = H. 2256 = Sh. 51.)

B is a faint star nearer than the old companion. Subsequently a still nearer attendant was detected, 317°·5 : 78″·17 (1878·9).

H	P = 151·4	D = 169·10	1783·6.

The change is probably due to proper motion. I am not acquainted with any modern measures. SH. connect a very distant 9 m. star.

No. 95. *τ Orionis.* (AB = ℍ V. 25 : AC = H. 2259.)

I found ℍ's companion, B, double with this instrument. There appears to be no change in B and C:—

HL.	P = 49°·3	D = 3″·77	1876·2	B*b*
	250°·1	35″·98	1876·2	AB
	59°·8	35″·97	1876·2	AC.

There may be an error in reading my first angle of the small pair. The new star would be at least 16 m. of H.'s scale. EDGECOMB sees it well with 9·4-inch. H. gave the angles of B and C, 250°·4 and 63°·8, respectively.

No. 96. *Orionis* 82. (AC = ℍ IV. 87 = S 475 = Σ 692.)

The large star was found to be a close pair with the 6-inch in 1874. The only other measures of this are by DE. The following is a mean of his four observations, and a late measure of my own:—

DE.	P = 355°·3	D = 0″·61	1876·1	Mags. 7·9 . . 8·7.
β	2°·9	0″·50	1878·1	

There is no change in the wide pair.

Σ	P = 4°·2	D = 34″·86	1831.5.

No. 97. MA. 1.

The first of a short list of new pairs by MA. in *Dorpat Observations*, (Vol. xi.) The distant star not in MA.

MA.	P = 158°·8	D = 3″·20	1843·2.

No 98. Σ 693.

No other measures since Σ. Probably unchanged.

Σ	P = 8°·9	D = 3″·65	1831·1
β	12°·5	3″·87	1877·9.

No. 99. 115 *Tauri.* OΣ 107.

Probably fixed, unless a small advance in the angle.

OΣ	P = 304°·9	D = 10″·15	1849·5
DE.	307·6	9·89	1867·9
β	308·4	10.18	1877·9.

OΣ speaks of a third star, smaller than B, in about 335°, which I did not see on this occasion, with full moon.

No. 100. 114, o, *Tauri.* (AC = ♅ V. 115.)

No measures in H., and nothing since, but ♅ gives for AC:—

♅	P = 192°·1	D = 51″·57	1783·7.

There is a faint 5″ pair in the direction of 218°·5.

No. 101. β *Leporis.* β 320.

The angular change of this pair is very apparent each year since its discovery in 1874. The annual motion appears to be about 10°. The distance seems to remain unchanged. The following are the measures of each season:—

β	P = 269°·1	D = ...	1875·00
DE.	267·1	2·89	1875·11
DE.	268·4	...	1875·08
DE.	279·9	2·71	1876·07
DE.	280·2	2·86	1876·08
HL.	279·7	3·12	1876·11
DE.	288·8	...	1876·76
DE.	289·3	2·91	1876·78
O.S.	287·2	2·67	1877·09
HL.	284·8	3·16	1877·10
β	289·4	...	1877·10
DE.	293·6	3·06	1877·15
SHP.	282·4	2·75	1877·19
DE.	294·4	3·01	1877·76
β	288·3	2·68	1877·89.

No. 102. 32 *Orionis*. Σ 728.

Probably a physical pair. It is now a difficult pair, and apparently closing up. Some of the measures are :—

	°	″	
H	P = 217·8	D = ...	1782·0
Σ	203·7	1·04	1830·9
DA.	205·1	0·89	1844·9
DE.	192·2	Con.	1863·3
OΣ	189·2	0·59	1874·2
β	196·2	0·45	1878·0.

No. 103. α *Leporis*. H. 3766.

There is no change in the angle of H.'s distant companion.

	°	″	
H	P = 154·8	D = 25±	
O. S.	156·1	35·66	1877·1
β	154·8	36·02	1877·9.

No. 104. θ′ *Orionis*. Σ 748.

There is but little change in the small stars, although some of the measures are very discordant. The present measures may be compared with the following:—

Fifth Star.

	°	″	
Σ	P = 353·6	D = 3·86	1832·5
OΣ	350·1	4·27	1863·3
β	354·3	4·02	1877·9.

Sixth Star.

	°	″		
DA.	P = 125·9	D = 3·62	1844·7	
OΣ	128·8	3·73	1858·8	
DE.	126·0	3·96	1867·0	
β	119·8	3·74	1877·9	
HL.	121·4	3·98	1878·0	(14 nights).

Several observers have seen, or believe they have seen, other minute stars in the trapezium, most of them using comparatively small aper-

tures. While making the measures given above, and at other times, under very favourable conditions, the interior of the trapezium and the vicinity of the principal stars were carefully examined. There was not the slightest suspicion of any additional stars. If the sixth star itself had been double, with a distance of 1″·0, it could not have been overlooked. I have very little faith in the real existence of these suspected stars after the failure of this and other large refractors to show them. It is wholly improbable that they should all be variable in such a manner as to render them at all times invisible within the last few years. In regard to the alleged variability of the fifth and sixth stars, I can only say that they have always been readily seen with my 6-inch glass in the last six years when the atmospheric conditions were suitable. So far as my own observations go, there appears to be no evidence of change in the light of these stars.

No. 106. *Leporis* 45. β 321.

The five principal stars constitute H. 3780, given in H. as "Classes 6 and 7," without measures. Together they are just visible to the naked eye, and rated by HEIS, 6–7 m. Two of these stars were found with my 6-inch to be close pairs. The minute star, χ, was added by HL.

No. 107. Σ 782.

The change is probably due to proper motion.

	P	D	
Σ	309°·4	36″·16	1831·2
DE.	308·6	38·66	1866·7
β	307·9	39·44	1877·9.

No. 110. OΣ 119.

The following are all the measures:—

	P	D	
MA.	306°·4	0″·55	1843·2
OΣ	303·9	0·64	1848·6
DE.	316·7	0·50	1867·6
DE.	316·3	0·60	1873·9
β	315·4	0·69	1878·1.

No. 113. *ν Aurigæ*. V. 90.

In the collected list of all the double star observations of ℍ the position angle is given 331°·8. In the way then employed of reckoning angles, this would correspond to 61°·8 *sp*. Assuming the quadrant to be *np*., as it certainly was, the agreement is complete. In this, as in many other instances, the measures of SM. in distance are altogether wrong. There is no other evidence of any change. Correcting the angle of ℍ as above, the measures stand:—

ℍ	P = 208°·2	D = 53″·72	1783·2
SM.	201·9	85·0	1833·7
β	207·0	54·97	1877·8.

No. 114. DE. 10. (AC = Σ 808.)

The close star was discovered by DE. in 1869. There is no change in Σ's. companion. The only other measures of AB are by DE.

DE.	P = 164°·5	D = 2″·72	1871·7
β	164·8	2·56	1877·8.

No. 116. *α Orionis*. (AC = ℍ VI. 39.)

The new star is something less than half the distance of ℍ's. companion. The mean value of the measures is:—

β	P = 348°·0	D = 77″·59	1877·9.

A single measure of C was made:—

ℍ	P = 152°·3	D = 161″·77	1786·9
β	152·3	174·7	1877·9 single distance.

No. 117. S. 503.

The change in AB, from proper motion, is very remarkable.

S.	P = 134°·1	D = 39″·94	1825·1
DE.	120·3	8·23	1873·8
DE.	118·6	7·07	1875·2.

(See DE., *Astr. Nach*. 2045.) The star I have measured is much nearer than C of S., and rather faint.

No. 118. OΣ 121.

A close and difficult pair. DE. suspected elongation in 190° in 1866. There is some change in the angle. The following comprise all the observations:—

	°	″	
MA.	P = 199·0	D = 0·27	1843·3
OΣ	191·4	0·39	1849·6
β	185·3	0·32	1878·1.

No. 119. θ *Aurigæ*. OΣ 545.

There are two distant stars which make ℍ V. 89 = ℍ VI. 34 = SH. 68. The close star forms one of the recent additions to the Pulkowa Catalogue. The only measures are:—

	°	″	
OΣ	P = 5·5	D = 2·15	1871·4
DE.	3·2	2·05	1875·9
β	3·8	1·90	1878·0.

As a 6-inch aperture shows the small star perfectly, it is a little strange that it should have been so long overlooked. There seems to be some change in the distance of C:—

	°	″	
ℍ	P = 286·0	D = 35·30	1783·7
DE.	292·4	45·27	1875·7
β	292·7	45·51	1878·0.

No. 121. Σ 826.

Some change in both angle and distance.

	°	″	
Σ	P = 115·5	D = 1·84	1832·4
DE.	122·2	2·22	1867·4
W. S.	128·6	1·77	1875·2
β	125·7	2·18	1877·9.

No. 122. Σ 848.

The stars measured by Σ appear to be relatively fixed. The small star is nearer than C and D of Σ. The only other measure is:—

	°	″	
DU.	P = 296·5	D = 15·16	1872·2.

No. 124. Σ 903.

No other measures since Σ. The small difference in distance is hardly sufficient to make any change probable.

	P	D	
Σ	P = 294°3	D = 23″32	1829·7
β	294·3	22·73	1878·2.

No. 125. Σ 910.

Slow retrograde motion is probable.

	P	D	
Σ	P = 170°9	D = 0″67	1829·5
Sᴇ.	165·6	0·6	1857·1
Dᴇ.	165·6	0·7	1869·1
β	162·5	0·93	1878·2.

No. 127. Σ 943 = S. 527.

The considerable movement shown here is probably due to the proper motion of the larger star.

	P	D	
Σ	P = 165°9	D = 15″46	1829·7
Mᴀ.	152·8	16·40	1844·2
Dᴇ.	148·5	18·00	1864·7
β	147·4	19·65	1878·2.

No. 128. H. 397.

H. records two companions, 30°± : 25″±, and 50°± : 40″±, with magnitudes 19 and 13 respectively, which was overlooked in making the measure, and the other companion not sought for. The one measured is smaller than 13 m. of H.

No. 130. Σ 955.

Change is not very well marked.

	P	D	
Σ	P = 272°6	D = 0″88	1830·6
Sᴇ.	276·3	1·09	1857·1
Dᴇ.	267·4	1·0	1869·5
β	272·2	1·00	1878·1.

No change in the third star, C. There is a faint star about 15″ *s.* of it.

No. 131. OΣ 154.

The distance is steadily diminishing in consequence of the proper motion of A.

	°	″	
OΣ	P = 136·3	D = 30·28	1848·8
OΣ	131·5	29·28	1861·3
DE.	131·7	28·76	1867·9
DE.	129·2	27·78	1877·3
β	129·0	27·77	1878·0.

No. 132. OΣ 155.

The movement is apparently rectilinear. The distances in my observations appear to be too small:—

	°	″	
MA.	P = 260·0	D = 13·61	1843·3
OΣ	262·1	14·91	1854·5
DE.	260·4	15·36	1867·8
FLM.	261·0	16·10	1877·8
β	259·7	15·07	1878·1.

No. 133. *Sirius.* A.G.C. 1.

For comparison we have measures with the Washington 26-inch:—

	°	″	
β	P = 52·4	D = 10·83	1878·0
HL.	51·7	10·76	1878·2.

No. 135. A.C. 4.

The following are all the measures:—

	°	″	
J.	P = 286·5	D = 1·±	1858·1
O. S.	290·8	0·93	1877·1
β	295·4	1·10	1878·0.

No. 136. 15 *Lyncis.* OΣ 159.

A binary system in rapid motion. It has been very carefully and regularly observed at Pulkowa:—

	°	″	
OΣ	P = 323·4	D = 0·53	1844·0
OΣ	341·6	0·49	1859·3
De.	354·9	Obl.	1867·9
β	361·0	0·48	1878·1.

The third star, C, is not mentioned in any of the earlier observations. It is a very faint object.

No. 137. OΣ 160.

Noted by De. in 1867, "aucun compagnon," and my 6-inch failed to show it under excellent conditions in 1876. The following are all the measures:—

	°	″	
Ma.	P = 154·7	D = 1·0	1843·3
OΣ	167·1	1·26	1848·2
β	174·2	1·43	1878·1·

No. 140. 41 *Geminorum.* OΣ 162 *rej.*

Rejected in the revised edition of 1850 of the Pulkowa Catalogue, and not measured by OΣ. De. could not see the companion in 1866, and it was beyond the reach of the 6-inch when examined by me in 1875. There is but a single observation prior to my measures. If both sets are reasonably accurate, the change is very marked.

	°	″	
Ma.	P = 164·9	D = 13·5	1843·3
β	154·8	20·98	1878·2

No. 141. ε *Canis Majoris.*

The measures are very discordant, largely due, perhaps, to the low altitude of the star in northern latitudes. The following are all I have been able to find:—

	°	″	
Maclear	P = 160·6	D = 7·48	1850·1
Se.	159·3	7·15	1856·1
Se.	155·1	5·20	1866·3
O. S.	162·0	7·65	1877·1
β	160·2	7·42	1878·2.

Probably without change.

No. 143. 45 *Geminorum.* OΣ 165.

A system in rapid angular motion, with a slow decrease in distance. The companion is so minute that it was not seen by De. in his measures of the OΣ stars. Under the best conditions it was invisible with the 6-inch in 1875. The only measures prior to mine are those of OΣ.

	°	″	
OΣ	P = 130·7	D = 3·87	1847·2
OΣ	119·3	3·35	1856·7
OΣ	89·7	2·89	1870·2
β	78·1	2·45	1878·1.

The change is probably due to proper motion.

No. 144. Σ 1031.

No other measures since Σ; probably unchanged. H. added a 14 m. star, 12″± distant. The conditions were not favourable enough on this occasion to measure it.

	°	″	
Σ	P = 251·6	D = 3·80	1831·2
β	248·3	3·33	1878·2.

No. 146. Σ 1058.

De. could not see any companion in 1865, and on three occasions in 1874–5 I failed with my 6-inch. All the stars in the vicinity were carefully examined with the large instrument, but nothing found agreeing with Σ's description, or likely to be his pair. Σ gave the magnitudes, 8·2 and 11·7, and as the distance is considerable, an aperture of 6 inches should deal with

it readily. If there is no error in the assigned place, this would seem to furnish an instance of the real disappearance of one of the components of a double star, and perhaps the only instance on record. The only measure since Σ is a single observation by Ma.:—

	°	″	
Σ	P = 282·7	D = 23·78	1832·2
Ma.	283·0	22·47	1844·1.

No. 147. *Canis Majoris* 164. Σ 1064.

An uninteresting pair, and now measured for the first time since Σ. There is no material change.

	°	″	
Σ	P = 237·7	D = 15·20	1831·2
β	239·6	14·96	1878·1.

No. 148. Σ. 1074.

A binary system in rapid movement.

	°	″	
Σ	P = 115·3	D = 0·47	1831·5
OΣ	129·4	0·61	1852·2
De.	135·9	Obl.	1863·1
W.S.	134·2	0·85	1874·1
β	140·0	0·71	1878·0.

I noticed two minute stars, 11°·8 : 15″·9 and 94°·5 : 12″±. (Inadvertently placed in the list of new pairs. *See* β 577.)

No. 149. Σ. 1071.

The distance is steadily increasing. With the exception of two observations by Ma., the following are the measures:—

	°	″	
Σ	P = 357·3	D = 15·52	1829·7
De.	5·0	15·87	1867·3
OΣ	7·7	16·18	1874·3
β	7·3	16·24	1878·0.

No. 150. Σ. 1081.

Slow angular motion, with but little change in distance.

Σ	P = 216°·1	D = 1″·33	1828·9
DE.	224·6	1·46	1867·8
β	226·1	1·36	1878·1.

No. 152. γ *Canis Minoris.*

The small star is given in the *Munich Observations*, but has not been measured since by any other observer:—

MU.	P = 247°·3	D = 34″·62	1836·3
β	243·2	32·60	1878·1.

No. 153. Σ 1097. (AB = β 332.)

In 1875 I found the principal star of Σ 1097 to be a close pair. D is mentioned by H., but not in Σ, and there are no other measures. No change in Σ's pair, AC. The fifth star, E, is very faint, and has not been before noticed.

No. 154. H. 760.

H. says, "the small star a *minimum visibile*," and estimates, 360°± : 30″±. The companion is about what I have called, 12-13 m.

No. 155. OΣ 175.

There seems to be an increase in the distance, but the angle remains about the same as when first observed.

OΣ	P = 333°·8	D = 0″·40	1847·6
DA.	329·4	0″·5±	1854·3
DE.	332·1	0″·81	1866·8.

No. 156. *Procyon.*

The distant attendant was detected independently by TALMAGE and DAWES, but it had been seen and measured a long time prior, as will appear from the measures given below. The change is due to the proper motion of the large star:—

MU.	P = 262°3	D = 56″59	1836-7
ROMBERG	294·9	45·8	1863·2
NE.	311·8	44·59	1874·0
β	317·3	44·62	1877·8.

When the last measures were made, and at other times, *Procyon* was carefully studied with all powers, but with no suspicion of any nearer star.

No. 157. Σ 1142.

There is certainly motion, probably rectilinear, but the measures of the last 20 years make the distance about the same:—

Σ	P = 275°9	D = 24″36	1829·5
DE.	262·0	22·83	1863·4
W.S.	258·1	22·8	1874·2
β	254·5	22·84	1878·2.

No. 158. Σ 1143.

This pair was measured by Σ in his first observation, but not seen on three several nights later, and it has never been seen since, although repeatedly looked for by DE. in 1863-4, and by myself in 1874-6. The failure of Σ to find it shortly after his measures is tolerably satisfactory evidence that there is some error in the place of the star as entered by him. I could not find anything in the immediate vicinity agreeing with his description.

No. 159. Σ 1152.

The only measures are given below:—

Σ	P = 312°9	D = 5″81	1830·7
O.S.	313·5	6·45	1876·0
β	314·1	6·05	1878·2.

No. 160. Σ 1154.

I find no other measures after Σ:—

Σ	P = 357°·9	D = 2″·26	1827·7
β	352°·9	2″·41	1878·2.

No. 161. 9 *Argûs*. β 101.

The measures present some evidence of angular motion, but the discrepancies may be due, to some extent, to the difficulty of the object. The measures of De. are a mean of three observations:—

De.	P = 289°·4	D = 0″·51	1875·6
β	302°·6	0″·41	1878·2.

No. 162. OΣ 183 *rej.*

No other measures except a single angle by Ma. of 14°·5 (1843·3). Companion not seen by De. in 1866.

No. 163. *Cancri* 5. Σ 1171.

Except Ma., De. is the only other observer who has measured this since Σ. From a comparison of the measures, my angle appears to be too large:—

Σ	P = 338°·6	D = 2″·80	1828·9
De.	330°·1	2″·49	1864·8
β	333°·8	2″·93	1878·1.

No. 164. Σ 1175.

Very decided change in angle and distance. It has been neglected since Σ, except by Ma. and De.:—

Σ	P = 204°·6	D = 2″·37	1831·2
De.	217°·8	2″·07	1866·8
β	222°·5	1″·81	1878·1.

No. 165. Σ 1213.

There seems to be a diminution in the distance. The following are all the measures:—

	°	″	
Σ	P = 327·6	D = 8·43	1830·9
De.	324·0	7·24	1867·7
β	325·1	7·43	1878·2.

No. 166. Σ 1216.

The physical relation of the components of this fine pair seems well established. Some of the epochs are:—

	°		″
Σ	P = 115·2	D = 0·45	1831·2
OΣ	139·4	0·49	1851·3
De.	151·1	Obl.	1863·3
W.S.	169·3	0·4±	1873·2
Gl.	167·0	0·5	1873·2
β	158·8	0·61	1878·2.

No. 167. OΣ 193 = H. 447.

Probably without sensible change.

	°	″	
OΣ	P = 295·1	D = 14·20	1851·0
De.	295·7	13·64	1868·1
β	298·1	14·17	1878·0.

No. 168. Σ 1230.

A slow increase in distance, with little or no change in angle.

	°	″	
Σ	P = 194·1	D = 28·00	1829·2
De.	192·4	29·25	1864·0
Gl.	193·0	30·8	1874·2
β	192·7	29·90	1878·2.

Error of 1″ in Gl.? The distance for 1874·2, on the basis of the measures of Σ and De., would be 29″·76.

No. 170. Σ 3119.

There is but one other observation since Σ. The motion appears to be rectilinear:—

	°	″	
Σ	P = 213·6	D = 24·82	1830·2
De.	214·2	25·98	1865·4
β	215·9	26·21	1878·2.

No 171. δ *Cancri*. H. 457.

The change is attributable to the proper motion of the principal star. During the total eclipse of the Sun of July 29, 1878, I saw this star very distinctly through the corona, at a distance of about 12′ from the Sun's limb. The following are all the measures of H.'s companion. The observation of Sm. is entirely erroneous :—

	°	″	
Mu.	P = 123·8	Δ Decl. 27·94	1836·1
Lassell	121·1	P = 45·82	1852·3
β	113·9	41·08	1878·2.

No. 172. ε *Hydræ*. Σ 1273.

The third star, which is very minute, was detected by Hn. with the Washington 26-inch. I do not know of any other measures. OΣ suspected an elongation of the principal star in 1860. I could not see any traces of duplicity on this occasion.

No. 173. Σ 1281.

The change is evidently due to proper motion :—

	°	″	
Σ	P = 329·6	D = 25·02	1833·5
De.	323·8	29·47	1864·5
β	321·3	31·18	1878·1.

No. 174. ρ *Hydræ*. A. G. C. 3.

A minute attendant detected by A. G.C. with the McCormick 26-inch. I know of no other measures. The mean of my three measures is:—

	°	″	
β	P = 144·9	D = 12·40	1878·0.

No. 176. Σ 1327.

Only measured since Σ by DE.:—

	°	″	
Σ	P = 81·4	D = 16·13	1831·3
DE.	80·2	14·08	1863·3
β	77·8	13·47	1878·1.

No. 177. Σ 1329.

Another instance of rectilinear motion.

	°	″	
Σ	P = 245·7	D = 27·19	1834·3
DE.	247·3	23·73	1864·7
β	248·4	22·84	1878·1.

No. 178. Σ 3121.

One of the most interesting and rapid of the binary systems. DOBERCK (1877) finds a period of 37·03 years. This pair has been carefully and systematically measured by OΣ and DE. My distance is certainly too large. It was estimated at the time 0″·25, and as the stars were just in contact with the high power, this estimate cannot be far out of the way :—

	°	″	
Σ	P = 20·0	D = 0·85	1832·3
OΣ	243·5	0·40	1840·3
OΣ	228·6	0·42	1850·3
DE.	189·6	0·68	1866·2
DE.	210·5	con.	1872·2
DE.	214·9	obl.	1874·2
DE.	251·9	oval	1875·3
β	185·2	0·36	1878·2.

No. 181. OΣ 207 *rej.*

An error in the distance of MA. would seem probable, as the angle must be increased 180°. Possibly some other pair may have been observed for this :—

	°	″	
MA.	P = 146·5	D = 16·05	1843·2
DE.	322·6	19·06	1867·5
β	323·2	19·24	1878·3.

No. 183. 8 *Sextantis.* A. C. 5

Discovered by A.C. in 1852 with an aperture of only $4\frac{3}{4}$ inches. There can be no doubt of its binary character. It is now an excessively difficult pair. The conditions were not very favourable, and the two measures differ widely, and neither of them agree with the single observation of O. S. The following are all the measures of this interesting system:—

	°	″	
DA.	P = 50·5	D = 0·5±	1854·2
DA.	38·2	0·5±	1860·3
DE.	173·8	...	1873·3
DE.	169·0	...	1875·3
O. S.	117·4	0·2±	1878·2
β	161·0	0·2±	1878·2.

No. 184. 31 *Leonis.*

Discovered by Mr. GEORGE ANDERSON with the Washington 26-inch. A fine object from the ruddy colour of the large star. The companion is a very minute point. The following are all the measures:—

	°	″	
HL.	P = 42·4	D = 7·48	1875·3
β	44·4	7·63	1878·2.

No. 185. α *Leonis.*

The minute companion to H.'s star was detected by the late Professor WINLOCK some years ago with the 15-inch of the Harvard College Observatory. The only other measures are by HL.:—

	°	″	
HL.	P = 85·0	D = 3·17	1876·3
β	88·5	3·29	1878·1

No. 186. Σ 1416 = H. 4293.

I am not aware of any other measure since that of Σ:—

	°	″	
Σ	P = 275·8	D = 11·25	1827·7
β	276·7	11·84	1878·3.

No. 187. 39 *Leonis*. OΣ 523.

Common proper motion, and probably physically connected.

	°	″	
OΣ	P = 295·6	D = 6·73	1851·3
De.	300·3	6·69	1866·9
β	298·7	6·67	1878·1.

No. 189. Σ 1423.

Angular motion is clearly shown.

	°	″	
Σ	P = 99·3	D = 1·12	1830·9
De.	76·8	1·27	1865·2
β	69·7	1·28	1878·2.

No. 190. H. 4311.

Noted by H. "exceedingly delicate." There is no indication of change in the angle.

	°	″	
H.	P = 122·3	D = 4±	
O.S.	126·3	4·38	1877·1
β	124·3	3·88	1878·4.

No. 191. Σ 1445.

The following are all the measures, except a single observation by Ma.:—

	°	″	
Σ	P = 167·4	D = 2·42	1827·6
De.	159·4	2·95	1864·9
β	160·0	2·71	1878·3.

The earlier measures appear to show that my angle is too large.

No. 192. H. 165.

Not measured by H. His description is, 330°±: 3″±.

No. 193. OΣ 226 *rej*.

The only other measure is an angle by Ma., 50°·5 (1843·3). The companion is now, as in 1874 when examined with my 6-inch, much smaller than 10 m., and not less than 11·8 m.

No. 195. DE. 14. (AC = Σ 1481).

The close star was discovered by DE. in 1864. There is no change in the distant star of Σ. The only measures of AB are:—

	°	″	
DE.	P = 193·0	D = 5·93	1864·8
β	194·1	6·02	1878·2.

No. 196. OΣ 230.

There is certainly slow motion in angle, but it is a difficult pair with small apertures:—

	°	″	
OΣ	P = 4·7	D = 8·65	1846·9
DE.	11·4	8·31	1867·3
β	13·4	8·36	1878·2.

No. 199. OΣ 234.

Without doubt we have here a binary system in rapid motion, but at all times it is a difficult pair. There is an error of some kind in one of the angles I have given, perhaps in reading the position circle. Both measures were made under very favourable conditions, and it would hardly be possible to make the angles so discordant without a blunder of some kind. In the first measure the stars were noted as just in contact with the highest power, and the distance is certainly under 0″·3. It was examined two or three times afterwards, but the definition was not good enough to make it worth while attempting measures. It will be reobserved at the first opportunity. The following are all the observations of this interesting system:—

	°	″	
MA.	P = 179·6	D = 0·25	1843·3
OΣ	177·5	0·43	1844·7
MA.	14·2	0·28	1847·4
OΣ	188·9	0·37	1848·7
OΣ	200·3	0·31	1852·1
OΣ	243	obl.	1858·9
OΣ	257	obl.	1861·3
OΣ		single	1866·
D.		single	1866·
OΣ	282	obl.	1870·5.

No. 202. OΣ 243.

On the whole it is doubtful if any material change has occurred.

	P	D	
	°	″	
OΣ	= 10·9	= 0·72	1846·0
De.	8·9	0·9	1867·9
β	14·5	0·94	1878·3.

No. 203. Σ 1607 = H. 202 = H. 516.

The third star, noted in H. 516, is not in Σ. It has not been measured before. The distance of Σ's pair is slowly diminishing from the effect of proper motion. Some of the observations are :—

	P	D	
	°	″	
Σ	= 350·3	= 33·07	1831·0
De.	355·0	31·35	1863·3
β	358·0	30·85	1878·3.

No. 205. OΣ 245.

There may be a small advance in the angle.

	P	D	
	°	″	
OΣ	= 275·1	= 8·33	1848·1
De.	276·9	8·25	1867·2
β	278·1	7·83	1878·3.

No. 206. OΣ 246.

Although retained in the revised Catalogue of 1850, it is rejected as single in the published measures of OΣ. De. found it single in 1866, as it certainly was on the present occasion. As a double star it may as well be rejected altogether.

No. 207. Σ 1630.

No other measures since Σ.

	P	D	
	°	″	
Σ	= 166·8	= 2·32	1832·5
β	171·5	2·59	1878·3.

Nos. 209, 210. OΣ 247 *rej.* and 248 *rej.*

Both rejected as single by OΣ in the Catalogue of 1850, and so found by DE. in 1866. I put them in my observing list for the reason MA. measured a suspected elongation as follows :—

	°	″	
OΣ 247	P = 26·2	D = 0·25	1848·4
OΣ 248	28·0	0·25	1843·3.

I have not the slightest doubt that both stars are really single.

No. 211. OΣ 249.

There is some evidence of orbital motion in the close pair, as will appear from the following, which are all the measures recorded :—

	°	″	
MA.	P = 330·5	D = 0·40	1843·4
OΣ	315·1	0·53	1853·2
DE.	311·4	0·5	1868·0
β	307·1	0·46	1878·3.

The third star was not observed by DE. The only earlier measure is that of OΣ.

	°	″	
OΣ	P = 149·7	D = 13·23	1855·9
β	148·3	12·68	1878·3.

No. 212. OΣ 250.

The only measures are as follows:—

	°	″	
MA.	P = 335·7	D = 0·42	1843·4
OΣ	330·7	0·44	1846·0
DE.	321·3	obl.	1868·1
β	329·0	0·47	1878·1.

No. 213. Σ 1641.

Retrograde motion, with a steady advance in distance. With the exception of a measure by MA., the following are all :—

	°	″	
Σ	P = 50·4	D = 6·14	1831·4
DE.	42·3	7·73	1867·6
3	39·2	8·96	1878·3.

No. 214. Σ 1643.

Probably binary. The only measures since Σ and Ma. are given here:—

Σ	P = 71°·2	D = 1″·94	1830·3
De.	54·4	1·79	1864·7
β	46·6	1·76	1878·3.

No. 215. Σ 1644.

There seems to be a slight change in the distance.

Σ	P = 248°·6	D = 21″·82	1827·5
De.	247·0	21·08	1867·9
OΣ	247·0	20·88	1870·3
β	246·7	21·06	1878·3.

No. 216. Σ 1675 = H. 520.

No other measure since Σ, and probably fixed.

Σ	P = 9°·6	D = 31″·07	1831·4
β	8·2	30·66	1178·3.

No. 217. OΣ 255.

Not seen by De. in 1866, and no other measures except an angle by Ma., 333°·3 (1845·3).

No. 218. Σ 1682.

The following are all the measures of this wide pair:—

Σ	P = 308°·8	D = 33″·65	1831·6
De.	306·9	32·34	1865·3
β	305·8	32·35	1878·3.

No. 220. Σ 1702.

The only measure since the observations of Σ shows no change in the components:—

Σ	P = 82°·7	D = 35″·65	1831·3
β	82·5	35·73	1878·3.

No. 221. Σ 1703.

A decided diminution in the distance.

Σ	P = 283°·1	D = 22″·65	1829·3
DE.	283·0	19·71	1865·3
β	281·5	18·79	1878·3.

No. 222. 46 *Virginis*. A. G. C. 6.

Discovered by A. G. C. with the 12-inch made for the Vienna Observatory. The following are all the measures I am acquainted with:—

HL.	P = 158°·9	D = 1″·32	1876·4
DE.	148·5	1·22	1877·4
O. S.	145·7	1·15	1878·2
β	151·5	1·48	1878·3.

The third star not noted before.

No. 224. Σ 1707.

With the exception of MA., the following are all the measures of this pair:—

Σ	P = 30°·9	D = 10″·22	1828·9
DE.	33·0	9·22	1865·3
FLM.	34·8	9·00	1877·5
β	35·5	9·84	1878·3.

No. 225. Σ 1711.

There seems to be a diminution in the angle and distance.

Σ	P = 355°·9	D = 1″·43	1829·3
DE.	348·4	1·28	1863·2
W. S.	352·3	1·13	1876·4
β	349·7	1·06	1878·3.

No. 226. H 2638.

H. only measured the angle of AB, 209°·6. I could not see C with the 6-inch.

No. 227. Σ 1727 = H. 527.

Probably unchanged.

	°	″	
Σ	P = 335·0	D = 7·26	1831·3
β	336·6	7·63	1878·3.

No. 228. 53 *Virginis*. H. 2645.

The description in H. is 30°± : 50″±, "position by diagram." In this, as in most similar pairs, the measures of Sm. are entirely erroneous.

No. 229. 61 *Virginis*. ♅ VI. 90.

The change arises from proper motion.

	°	″	
♅	P = 345±	D = 73·25	1783·0
Kn.	22·6	169·29	1862·3
β	25·2	189·96	1878·3.

No. 230. Σ 1737 = H. 224.

This pair is also ♅ IV. 57, there being an error of 43′ in the Decl. of ♅. No evidence of change.

	°	″	
♅	P = 223·5	D = 17·08	1782·
Σ	220·5	15·12	1829·3
β	220·2	15·13	1878·3.

No. 232. OΣ 268 *rej*. (AC = ♅ V. 70 = H. 2657.)

No other measures of AB. For AC we have:—

	°	′	
♅	P = 277·0	D = 56·93	1783·2
Dr.	259·5	67·39	1870·3
β	259·0	67·86	1878·3.

Probably error in the angle of ♅, as H. gave 259°·4.

No. 233. H. 2659.

H. has only estimates, 315°± : 10″±, and adds, "one of the most difficult, but a haze is come on. Requires verifying." On this occasion I could not find any companion, but the night was not very favourable.

No. 234. H. 3340.

Noted by H. as "very difficult"; 204°·5 : 1″±. It would hardly be safe to infer any change under the circumstances. No other recent observations.

No. 235. H. 3341.

The only double star ever discovered by Sm., and this was found with one of the large reflectors of H. It is a short distance preceding the cluster M 3. I have seen it perfectly with the 6-inch aperture. Da. noted it as "excessively difficult." His estimate of the distance is so much at variance with that of H., the evidence of change is unsatisfactory:—

	°	″	
H.	P = 190·0	D = 1½±	1835·5
Da.	196·9	0·8±	1848·4
β	193·8	2·68	1878·2.

No. 237. Σ 1775.

The only recent measures indicate no change in the components.

	°	″	
Σ	P = 335·7	D = 27·75	1829·3
β	335·7	27·80	1878·3.

No. 238. Σ 3081.

De. failed to see the companion in 1865, and we have no other measures since Σ. There seems to be change in the angle.

	°	″	
Σ	P = 76·3	D = 1·97	1830·6
β	67·2	2·02	1878·3.

No. 239. *τ Boötis.* OΣ 270.

The components have a common proper motion, and are probably physically connected. There is a slow increase in the position angle, and apparently a diminution in distance:—

OΣ	P = 347°8	D = 10″26	1849·5
De.	348·9	9·04	1867·4
β	351·9	8·71	1878·3.

No. 240. Σ 1784.

Neglected since Σ, but probably fixed.

Σ	P = 207°1	D = 8″66	1832·5
β	208·7	9·00	1878·3.

No. 241. OΣ 272.

Taken together, the measures do not furnish much ground for suspecting motion, unless in distance:—

OΣ	P = 23°5	D = 1″89	1849·6
De.	17·8	1·79	1866·7
β	20·9	1·41	1878·3.

No. 242. Σ 1791.

Overlooked by all late observers. It is an insignificant object, and apparently without change.

Σ	P = 159°8	D = 20″46	1829·3
β	159·7	21·12	1878·3.

No. 243. Σ 1801.

Not unlike the last. Examined by De. in 1865 but the small star not seen. My measures indicate a considerable increase in distance.

Σ	P = 64°5	D = 18″44	1828·3
β	67·5	19·37	1878·3.

No. 245. Σ 1805.

One of the observations of MA., credited to this pair, belongs to Σ 1809.

	°	″	
Σ	P = 30·5	D = 4·54	1832·4
SE.	34·1	4·96	1856·4
β	34·5	4·70	1878·3.

No. 246. Σ 1809.

Probably without sensible variation. The measure of MA. is attached to Σ 1805 in the *Dorpat Observations*.

	°	″	
Σ	P = 196·7	D = 4·14	1832·1
MA.	194·9	4·34	1858·4
β	194·8	4·09	1878·3.

No. 247. Σ 1820.

The angular motion of this pair is clearly shown.

	°	″	
Σ	P = 47·9	D = 2·40	1834·1
DE.	60·5	2·11	1866·7
DU.	63·2	2·27	1871·4
OΣ	68·0	2·64	1874·7
β	67·4	2·32	1878·3

No. 248. Σ 1827. (AC = H. 1251.)

There is no doubt of angular motion, but some of the measures are very discordant. DE. found it non-measurable in 1863:—

	°	″	
Σ	P = 118·3	D = 0·44	1830·3
OΣ	128·9	0·58	1850·1
β	131·4	0·65	1878·3.

There are no other measures of C, except H.'s angle of 65°·5′.

No. 250. Σ 3083.

The only measures of this pair make the stars relatively fixed.

Σ	P = 230°·3	D = 4″·55	1832·7
β	230·7	4·48	1878·3.

No. 251. Σ 1843 = H. 2722.

Fixed.

Σ	P = 188°·1	D = 20″·15	1830·6
β	187·7	20·02	1878·3.

No. 252. Σ 1847.

There has been a considerable change in the components, probably the result of proper motion:—

Σ	P = 248°·4	D = 18″·73	1829·8
Mh.	253·1	20·17	1848·4
Dr.	256·0	21·67	1865·4
β	257·8	22·63	1878·3.

No. 253. OΣ 283.

There is but little, if any, change. The last of OΣ is a single measure, and possibly 10° in error:—

OΣ	P = 134°·6	P = 4″·93	1848·2
Dr.	130·1	5·11	1866·8
OΣ	141·3	5·27	1875·5
β	131·1	5·00	1878·3.

No. 254. OΣ 284.

It seems to be relatively fixed.

OΣ	P = 106°·3	D = 6″·98	1848·2
Dr.	102·3	6·79	1866·7
β	102·4	7·17	1878·3.

No. 256. Σ 1874.

No other measures.

	°	″	
Σ	P = 288·4	D = 25·73	1830·6
β	288·6	26·32	1878·3.

No. 257. Σ 1879.

Probably a binary pair, and now a difficult object. DE. found it single, or a doubtful elongation in 1863–5. My measures show the smaller component to be now in the opposite quadrant to that in which it was when measured by Σ. There should be no mistake about it then, as it was a wide, easy pair, and I am certain there is none now, for the *sp.* star was particularly noted as being at least half a magnitude the smallest:—

	°	″	
Σ	P = 67·3	D = 1·18	1830·0
MA.	57·2	0·69	1843·4
SHP.	39·1	0·37	1877·4
DE.	42·9	0·34	1877·5
β	217·1	0·42	1878·4.

No. 258. μ *Libræ.* β 106.

This very easy pair was found with the 6-inch in 1873. For comparison we have the following:—

	°	″	
DE.	P = 335·0	D = 1·31	1875·1
SHP.	335·3	1·57	1875·4
O. S.	335·8	1·67	1877·4
β	333·2	1·50	1878·3.

The third star not noticed heretofore.

No. 259. H. 5489.

The description in H. is, 20°±:15″±:6 . . . 20. HL. has examined this with 26-inch, and finds no such companion, the nearest being 207°·6: 55″·78:6 . . . 16 (1875·4). I could not see it on this occasion, and measured a very distant star *nr.*

No. 260. β 31.

A pretty pair, near ξ *Boötis*. The close pair was found with the 6-inch, in measuring which the third star was detected.

No. 261. H. 2752.

Measured by Ma. as new. Evidently fixed.

	P	D	
H.	P = 131°·2	D = 4″½	1830
Ma.	126·3	5·44	1843·3
β	126·5	5·84	1878·3.

No. 262. P. XIV. 212. Sh. 190 = H N. 28.

A system not unlike 61 *Cygni*, having large proper motion, and probably physical relation between the components. Some of the measures of AB are :—

	P	D	
Sh.	P = 270°·1	D = 10″·82	1823·3
H.	277·4	12·08	1836·7
Main	283·9	13·51	1862·4
O. S.	290·2	14·98	1877·4
β	290·8	15·33	1878·4.

H. noted a 16 m. star from B, 320°·0 : 20″±. This is the star F of my measures. The change in angle and distance corresponds to the proper motion of A. In the course of time B and C will form a moderately close pair. C is the faintest star of the group. The distant stars measured by single distances.

No. 263. 59 *Hydræ*. β 239.

The only other measures were made with the 6-inch without a driving clock:—

	P	D	
β	P = 123°·7	D = 0″·8±	1874·5
β	129·5	0·93	1878·4.

No. 264. 2 *Serpentis*. β 348.

This pair seemed much more difficult than when I found it with the 6-inch in 1875, and appeared closer, although the measures do not show it. There is perhaps some change in the angle.

	°	″	
DE.	P = 114·0	D = 0·4	1875·5
DE.	116·6	c·58	1876·4
SHP.	119·0	0·5±	1876·5
β	121·4	0·51	1878·4.

DE. gives the colours, yellow, ash.

No. 265. Σ 1914 = S. 667.

Probably without change. The following are all the measures:—

	°	″	
Σ	P = 336·4	D = 30·94	1827·4
FERGUSON	335·7	31·25	1863·5
β	335·8	31·32	1878·3.

No. 266. Σ 3091.

There is a very great change in the distance. DE. mentions only a doubtful elongation in 45° in 1863, and HL. could find no close pair here with the 26-inch in 1875. I was never able to see the least trace of duplicity with the 6-inch. Hence, it has probably been single and is now commencing to open, but is still very difficult. SE. records a single measure of Σ 3091, 243°·0 : 0″·5 (1859·6), but gives an entirely different place: R.A. $15^h\ 45^m$; Decl. 319′. Certainly that cannot be this pair, or it would have been seen by DE. in 1863. It is highly improbable that the distance should have remained constant during the 27 years between Σ and SE., and the star become single in the five years succeeding. I carefully examined the place given by SE., and could find nothing of the kind there.

The following are the measures to this date:—

	°	″	
Σ	P = 227·3	D = 0·50	1832·4
β	225·0	0·25±	1878·4.

The stars are equal, so that it is not unlikely the real change would be better shown by applying a correction of 180° to the last angle.

No. 267. OΣ 294.

The only measures are as follows:—

	°	″	
OΣ	P = 251·3	D = 3·26	1848·6
DE.	247·8	3·23	1867·6
β	248·7	2·75	1878·3.

No. 269. OΣ 295.

The angles are too discordant to make change certain.

	°	″	
MA.	P = 114·8	D = 0·77	1843·3
MA.	113·1	0·7	1846·1
OΣ	128·4	0·74	1846·4
DE.	122·9	0·85	1866·8
β	128·7	0·75	1878·4.

No. 271. Σ 3093.

Decided motion.

	°	″	
Σ	P = 135·5	D = 33·38	1829·4
DE.	138·6	31·15	1865·3
β	139·9	30·79	1878·3.

No. 274. γ *Libræ.*

This distant companion, noted by GOLDSCHMIDT, has not been measured before.

No. 276. Σ 1961.

The change is due to proper motion.

	°	″	
Σ	P = 56·0	D = 21·55	1830·6
DE.	47·8	22·23	1866·8
β	44·6	22·45	1878·3

No. 277. OΣ 298.

Rapid orbital motion. This has been measured by several observers. The character of the movement will be seen from the following:—

	°	″	
OΣ	P = 181·6	D = 1·20	1846·5
DE.	208·9	0·99	1866·4
DU.	214·1	0·58	1869·5
OΣ	235·8	0·58	1872·6
OΣ	264·3	0·53	1875·5
DE.	280·9	0·3±	1876·5
DE.	295·2	0·3	1877·4
β	310·7	0·27	1878·3.

No. 279. Σ 1964. (AB = ♅ IV. 61 = H. 255 = S. 674.)

No change in AB. There are no other recent observations of the close pair.

	°	″	
Σ	P = 8·1	D = 1·34	1830·9
β	10·0	1·34	1878·4.

No. 280. Σ 3095.

The measures given below are all that have been made of this pair.

	°	″	
Σ	P = 349·7	D = 2·85	1831·3
DE.	336·9	2·75	1865·4
β	337·8	2·83	1878·4.

No. 282. ε *Coronæ*. A.G.C. 7.

This very difficult and unequal pair was discovered in 1876 by A. G. C. with the MCCORMICK 26-inch object-glass. EDGECOMB sees it easily with a 9·4-inch Clark Refractor, but observers generally will require a much larger aperture. The only other measures are given below:—

	°	″	
HL.	P = 351·4	D = 2·17	1876·4
β	360·2	1·86	1878·3.

No. 283. Σ 2001.

A comparison of the only measures recorded of this pair shows a fixed relation of the components:—

	°	″	
Σ	P = 169·6	D = 11·57	1829·7
β	168·8	11·93	1878·3.

No. 284. Σ 2006.

There appears to be slow motion in the angle.

	°	″	
Σ	P = 204·5	D = 1·61	1830·9
Dʀ.	197·4	1·65	1869·3
β	196·8	1·66	1878·4.

No. 285. *ν Scorpii.* β 120.

The conditions were not very favourable, and my distance may be too large; but the close pair is much easier than when I found it in 1873, when it was estimated 0″·4, and I have no doubt it is opening:—

	°	″	
β	P = 357·7	D = 0·4±	1874·4
Dʀ.	359·5	0·59	1875·1
Dʀ.	360·6	0·79	1877·5
β	363·7	1·04	1878·3.

For measures of the wide pair (♅ V. 106), and of the double companion, with details of measures of AB, see *Monthly Notices*, November 1874.

No. 286. Σ 2022.

Perhaps some angular movement.

	°	″	
Σ	P = 129·5	D = 2·77	1830·6
OΣ	138·7	2·78	1868·5
β	136·4	2·89	1878·4.

No. 288. Σ 2036. (AC = H. 3345.)

H. does not mention the close star, nor Σ the distant one. As the place given by H. is almost exactly that of Σ, I suspected the principal star of both pairs might be identical, but was never able to see the small star with the 6-inch. The description in H. is, 339°·9 : 12″± : 9 . . . 16; "excessively difficult, but hazy." With the large aperture it was of course readily seen, and found to belong to Σ 2036. Of the latter I find no other measure. The difference in the angles is too great for errors of observation in a pair of this kind:—

Σ	P = 235°·3	D = 2″·01	1832·3
β	241·5	2·18	1878·4.

No. 290. *η Draconis.* OΣ 312.

Some change in distance is probable.

OΣ	P = 144°·0	D = 4″·67	1843·7
OΣ	142·3	4·86	1851·2
DE.	141·2	4·85	1866·3
OΣ	145·5	5·20	1873·7
β	141·7	5·26	1878·4.

Rogers suspects variability in the small star.

No. 291. Σ 3105.

Apparently slow retrograde motion.

Σ	P = 57°·5	D = 0″·62	1835·6
DE.	53·2	0·5	1870·0
β	50·9	0·61	1878·5.

No. 292. Σ 2062.

If not variable, the companion is certainly smaller than 10 m., as found by Σ. DE. could not see it under excellent conditions in 1865·3. In April 1874 it was seen by me with the 6-inch, but difficult; in June 1874 it was

invisible on a first-class night; and in May 1875 it was well seen with high powers. There is no reason to suspect any change in either angle or distance. The following are all the measures I have found:—

	°	′	
Σ	P = 112·9	D = 2·30	1832·1
Sh.	114·5	2·11	1857·0
β	114·2	2·80	1878·4.

No. 294. Σ 2092.

No other measures.

	°	″	
Σ	P = 5·9	D = 8·04	1831·1
β	5·2	8·18	1878·4.

No. 295. Σ 2106.

The angle is certainly less than found by Σ, but the later measures are very discordant in angles:—

	°	″	
Σ	P = 337·5	D = 1·01	1827·3
Dr.	321·3	0·5	1863·5
OΣ	322·8	0·67	1871·8
W. S.	309·7	0·5±	1873·5
Gl.	310·9	0·5±	1874·4
W. S.	329·8	0·4±	1875·6
β	323·7	0·64	1878·4.

No. 296. Σ 3106.

The motion indicated by the single observation of Sh. is not supported by my measures:—

	°	″	
Σ	P = 246·5	D = 2·35	1831·9
Sh.	250·6	2·20	1859·5
β	246·8	2·19	1878·5.

No. 297. OΣ 317.

The change appears to be due to the proper motion of the large star, which, according to OΣ, is −0″·025 in R.A. and +0″·096 in Decl.

OΣ	P = 234°·5	D = 15″·73	1848·7
OΣ	226·4	16·91	1874·7
β	228·5	17·30	1878·3.

No. 299. Σ 3107.

Retrograde motion in angle.

Σ	P = 112°·3	D = 1″·59	1831·9
Dɛ.	104·4	1·32	1864·5
β	100·1	1·38	1878·5.

No. 300. OΣ 321.

Probably without sensible change.

OΣ	P = 1°·7	D = 0″·51	1848·8
Dɛ.	5·2	obl.	1866·4
β	2·6	0·55	1878·5.

No. 301. Σ 2117

Companion not seen by Dɛ. in 1863. Probably fixed. The only measures are:—

Σ	P = 117°·0	D = 1″·36	1831·5
Mᴀ.	113·7	1″·15	1843·6
β	116·3	1·29	1878·3.

No. 304. 60 *Herculis*. Ḥ. V 133.

There are no other observations of this distant companion since Ḥ, except those found in Sᴍ.:—

Ḥ	P = 307°·0	D = 48″·67	1783·2
β	309·8	53·38	1878·5.

No. 308. OΣ 327.

No certain elongation in 1866 to De., and certainly single now. The following are all the measures:—

Ma.	P = 159°·8	D = 0″·37	1843·4
OΣ	340°·6	0″·44	1846·4.

No. 310. 72 *Herculis*. σ 544.

Only found in Σ's first Catalogue, and without description. All the stars properly called double were incorporated in *Mensuræ Micrometricæ*, and Σ evidently referred to some distant star. The nearest is a 10 m. star in the direction of 331°·1, and this has a minute 3″ attendant in 213°·3.

No. 311. Σ 2163.

The following are all the measures:—

Σ	P = 103°·5	D = 1″·51	1830·0
Se.	97°·8	1″·46	1858·9
De.	95°·0	1″·5	1866·5
β	97°·2	1″·88	1878·3.

No. 312. Σ 2172.

Probably unchanged.

Σ	P = 173°·1	D = 11″·55	1830·8
β	170°·5	11″·62	1878·5.

No. 313. Σ 2175.

H. suspected a star nearer than the 10″ companion of Σ. Nothing seen on this occasion. There is no change in Σ's pair.

No. 315. Σ 2190.

There seems to be an error of 10° in Σ, since the angle has remained unchanged for the last 15 years.

	°	″	
Σ	P = 33·2	D = 10·17	1829·7
MA.	33·7	10·17	1843·7
DE.	23·0	10·18	1863·4
KN.	23·4	9·63	1872·4
W.S.	24·9	10·58	1876·5
β	23·9	10·16	1878·5.

H. 2807 has exactly the same R.A., but 25′ south, and is described, 22°·4 : 8″ : 7 . . . 11. There is no 7 m. star in or near this place, and no double of this description. The observation of H. undoubtedly refers to Σ 2190, and as it was made about the time of Σ's measure, it supports the theory of an error of 10° in the printed angle of the latter. The observation of MA. is on a single night, and many mistakes of this kind are found in his series.

No. 316. OΣ 333.

A suspected close pair, and retained in the Pulkowa Catalogue of 1850, but not afterwards seen double by OΣ. DE. found it single in 1865, as I have on prior occasions with the 6-inch. The only evidence favouring duplicity is in two doubtful measures of MA., 154° : 0″·2? (1845·0). There is not much doubt of this star being single.

No 317. DE. 16. (AB = Σ 2214.)

The duplicity of Σ's companion was discovered by DE. in 1863. There is no change in Σ's pair. For the close pair we have:—

		″	
DE.	P = 143·3	D = 1·5	1863·6
OΣ	154·0	1·43	1869·7
β	147·9	0·97	1878·3.

No. 318. μ *Herculis*. A. C. 7.

A few of the measures will indicate the rapid motion of this interesting binary:—

	°	″	
Da.	P = 60·4	D = 2·05	1859·7
OΣ	78·5	1·50	1862·8
OΣ	98·7	0·88	1868·5
OΣ	156·8	0·62	1871·5
OΣ	185·5	0·63	1873·5
Ne.	202·4	0·75	1874·5
Hl.	220·6	1·18	1875·7
Hl.	223·4	0·72	1876·6
De.	229·7	0·87	1877·5
Hl.	232·8	0·85	1877·6
β	234·9	1·05	1878·5.

No. 322. Σ 3128.

The change indicated by the two sets of measures by Σ is not supported by my single observation:—

	°	″	
Σ	P = 31·4	D = 1·51	1831·4
Σ	24·0	1·52	1835·6
β	35·0	1·25	1878·3.

No. 324. H. 4995.

H. 4995 is described, 140° ± : 18″ ± : 6½ . . . 12 ; "a third closer suspected." No third star could be seen on this occasion, which was sufficiently favourable to make the existence of any such companion very improbable.

No. 326. (AC = ♅ N. 40 = ♅ N. 6 = Sh. 379.)

The star B was discovered by H., having been overlooked by ♅ and Sh. D was added by Langley with the Harvard College Refractor, and also one of the fainter companions, probably G. The other members of the group were

detected by Hn., who has thoroughly investigated the question of the apparent proper motion of the great trifid nebula which surrounds this multiple system. (See *American Journal of Science*, Vol. xiv., pp. 433–458.)

The following measures are by Hn. with the Washington 26-inch:—

	°	″	
A and B	P = 22·7	D = 6·49	1875·6
A and C	210·7	10·75	1875·6
C and D	283·4	2·40	1875·6
C and E	192·6	5·80	1875·6
A and F	106·7	19·50	1875·6.

There is no evidence of change in the old components.

No. 327. 70 *Ophiuchi.*

J. suggested the existence of a third star by way of explaining some apparent irregularities in the orbital motion, and some observers have suspected an elongation of one of the components. Both stars were perfectly round with the highest powers on this occasion, as they have always been to me heretofore, and no trace of any third star near.

No. 328. 72 *Ophiuchi.* (AB = OΣ 342.)

On several occasions OΣ measured a companion at a distance of about 1″·5 in *nf.* quadrant, the last observation being in 1876. Ne., on two very fine nights in 1874, saw no trace of any close star with the 26-inch, and Hl. was equally unsuccessful in 1876. I examined A several times, but found nothing. There is an excessively faint star, nearer than H.'s companion, detected by Ne. when looking for a close star. I saw it fairly, but did not measure it. Ne. gives, 292° : 26″.

No. 329. 99 *Herculis.* A. C. 15

This pair, like many others, has unfortunately been entirely neglected since the first measures by Da. shortly after its discovery in 1859. The change is very marked both in direction and distance. It is now, from the inequality of the components, a rather difficult pair. The following are all the measures :—

	°	″	
Da.	P = 347·1	D = 1·71	1859·6
β	24·4	0·99	1878·5.

No. 330. 102 *Herculis*. A. G. C. 8.

No other measures of this minute attendant. It was detected by A. G. C. in 1875 with a 12-inch aperture.

No. 331. μ *Sagittarii*. (AC = β 292.)

The minute star between A and D of H. was picked up by me with the Washington 26-inch, and is now measured for the first time. No certain indications of change in H.'s nearest star:—

MU.	P = 259°·9	D = 16″·08	1836·5
O. S.	258·4	17·10	1877·6
β	259·2	16·91	1878·4.

No. 332. 16 *Sagittarii*. β 286.

This also was found with the Washington 26-inch in 1874. The last measure was made so soon after sunset that no artificial illumination of the wires was necessary. The mean result is:—

β	P = 218°·5	D = 5″·67	1878·5.

No. 333. H. 2827.

The description in H. is, 254°·8 : 15″± : 9–10 = 9–10; "a very remarkable object; a double star in a pretty large, bright, oval nebula 50″ in diameter."

No. 336. *Herculis* 452. Σ 2315.

Some of the measures of this close binary are:—

Σ	P = 281°·1	D = 0″·59	1830·7
OΣ	257·6	0·53	1863·7
NE.	250·3	0·39	1874·6
SHP.	247·0	0·38	1875·9
β	251·7	0·31	1878·4.

It appears to be slowly closing up.

No. 337. Σ 2318.

The following are all the measures of this pair:—

	°	″	
Σ	P = 257·1	D = 12·85	1829·7
Ma.	256·8	20·03	1843·7
De.	255·7	20·66	1865·1
Hd.	255·3	20·85	1866·7
β	254·9	20·81	1878·4.

There seems to be a slow retrograde movement in the angle, but it is evident the distance could not have been as given by Σ if the later measures are correct. The close agreement in all the later distances makes it almost certain that there is an error of some kind in Σ. I have already suggested (*Astr. Nach.*, 2210) that a mistake in a single figure in transcribing or printing the distance of Σ may have occurred; and if we suppose the figures to be 19″·85, instead of 12″·85, the whole series of observations would substantially harmonise. I hope the original records will be examined to see if this is the case: I have carefully looked for any other pair in this vicinity agreeing with Σ's description, and find none.

No. 338. OΣ 351.

The measures do not make change probable.

	°	″	
OΣ	P = 25·0	D = 0·49	1846·4
De.	30·6	obl.	1867·7
β	29·7	0·63	1878·4.

No. 339. Σ 2327.

Companion not seen by De. in 1864. Apparently fixed.

	°	″	
Σ	P = 314·9	D = 19·27	1830·8
β	316·0	19·01	1878·4.

No. 340. OΣ 355 = H. 862.

This is a wide pair, the larger of which Ma. measured as a close pair, 18°·2 : 0″·25 (1843·5). Probably error in Ma., as OΣ did not regard it as a close pair.

No. 341. Σ 2344.

Noted as single, or not found, by several observers (see *Astr. Nach.*, 2106); but this is undoubtedly to be attributed to mistaking for it a brighter star in the immediate vicinity which now more nearly agrees with the magnitude assigned by Σ. The principal star of Σ 2344 is only 9·3 m. in Argelander, and that is about what it appears now. There is no other measure since Σ.

Σ	P = 179·0°	D = 1·38″	1829·7
β	180·4	1·58	1878·4.

No. 342. OΣ 357.

At all times a difficult pair. Some of the measures are not very accordant:—

OΣ	P = 275·5°	D = 0·48″	1845·1
OΣ	264·4	0·53	1855·7
OΣ	256·9	0·53	1872·6
β	258·9	0·52	1878·6.

No. 343. α *Lyræ*.

The minute star, C, was discovered by WN., and the measures made at that time are all I am acquainted with preceding my own. The change corresponds to the proper motion of A.:—

WN.	P = 298·8°	D = 46·87″	1864·8
β	292·0	51·85	1878·4.

I have examined α *Lyræ* once under very favourable conditions with the Washington 26-inch when the star was near the meridian, and many times with the 18½-inch, but have never seen the slightest trace of the close stars supposed to have been seen by BUCKINGHAM and others. (*Monthly Notices*, November 1867.)

These were certainly not real stars, but optical illusions of some kind, due to the observer or the instrument. The object-glasses of Alvan Clark & Sons rarely give these spurious images in the vicinity of bright stars.

No. 344. Σ 2358.

Apparently unchanged.

	°	″	
Σ	P = 216·5	D = 2·58	1831·4
SE.	219·5	2·44	1857·7
β	218·5	2·90	1878·5.

No. 345. Σ 2384.

This pair is still apparently single, as found by DE. in 1865. The plane of motion appears to be nearly in the line of sight:—

	°	″	
Σ	P = 307·2	D = 0·82	1832·3
DA.	312·8	0·7	1841·0
OΣ	318·0	0·61	1846·3
DA.	332·9	0·3±	1854·8.

No. 346. SH. 277.

A and B make the well-known "debilissima" pair between ε^1 and ε^2 *Lyræ*, with which I have connected by measures two fainter stars near by. I am not aware of any prior measures, with the exception of H., 221°·0 : 45″± : 13 = 13.

No. 347. β *Lyræ*. (AC = β 293.)

The minute star, C, noted with the Washington 26-inch, has not been measured before. The companion of Σ appears to be fixed:—

	°	″	
Σ	P = 149·8	D = 45·77	1835·2
β	149·1	45·64	1878·4.

No. 348. OΣ 364.

OΣ has a single measure of a small star, 162°·8 : 0″·74 (1842·7), but he was unable to see it after that time, and is inclined to attribute the observation to some illusion.

On two occasions I failed to see any trace of duplicity.

No. 349. *Lyræ* 91. OΣ 525. (AC = Sh. 282.)

De. called the small star 9·5 m., and OΣ, 10·3. To me it has always seemed much fainter, and was very difficult with the 6-inch. Da. says: "about the most difficult object I could measure with $7\frac{1}{2}$ inches, and nearly the *min. vis.*" The following are the measures of AB :—

	°	″	
OΣ	P = 128·0	D = 1·55	1849·7
Da.	124·5	1·86	1853·7
De.	132·8	1·36	1869·8
β	124·6	1·56	1878·4.

No. 350. OΣ 365. (AC = Σ 3130.)

There is no change in the 3″ companion of Σ. In 1841 OΣ found the large star a close pair. In 1852 it was single, and again in 1865. It is probably a binary of short period. The following are all the measures:—

	°	″	
OΣ	P = 168·1	D = 0·50	1841·6
OΣ	...	single	1852–4
OΣ	166·1	0·50	1857·7
De.	...	single	1865–6
β	...	single	1878·4.

No. 351. γ *Lyræ*. OΣ 544. A. G. C. 9.

One of the recent additions to the Pulkowa numbers. It was found some years ago by A. G. C. with a 12-inch glass:—

	°	″	
OΣ	P = 296·9	D = 13·79	1868·6
Nn.	297·8	12·48	1874·5
β	301·1	12·76	1878·4.

No. 352. ζ *Sagittarii*.

This was found by Winlock many years ago to be a close pair with the Harvard College 15-inch, but no facts, so far as I am aware, have been

published in relation to it. The only measures to be found are those of Nɛ., in the *Washington Observations*, 1867. I have examined this star many times in the past few years with the 6-inch, and with larger apertures, but never have been able before to see it double. It is certainly now about as it was in 1867, and possibly there is no change; but it seems strange that I should at all times have failed to see at least some signs of duplicity. It will be observed that the angle is reversed in my measure. The following star was decidedly the smallest, but the difference is not large enough to infer change from the reversal of the angle. There may have been an occultation since 1867, or the low declination may explain the negative results heretofore:—

Nɛ.	P = 260°8	D = 0″48	1867·8
β	84·2	0·42	1878·7.

There is a very distant star which makes ♅ V. 78.

No. 353. Σ 2434.

The close pair has considerable angular motion.

Σ	P = 80°5	D = 1″93	1831·6
Dɛ.	69·6	1·79	1864·7
O.S.	63·3	1·58	1877·7
β	64·1	1·53	1878·6.

No. 354. ζ *Aquilæ*. β 287.

The companion was found by me in 1874 with the Washington 26-inch A fine object with a large aperture. Edgecomb sees it with a 9·4-inch Clark Refractor. The only measures are the following:—

Nɛ.	P = 58°9	D = 5″53	1874·6
β	59·6	4·92	1878·5.

No. 355. AB = Σ 2462.

I have added two minute stars, all about the same distance from the primary. No material change in AB.

No. 358. OΣ 368.

The small star, C, does not appear to have been seen before. There is but little change, if any, in the close pair.

	°	″	
OΣ	P = 217·5	D = 0·81	1850·4
DE.	214·5	0·94	1867·1
β	216·2	1·03	1878·7.

No. 360. Σ 2514.

The motion is apparently rectilinear. The following are all the measures:—

	°	″	
Σ	P = 277·0	D = 7·39	1832·7
DE.	306·8	8·12	1866·6
β	316·3	8·51	1878·4.

No. 361. Σ 2512.

The only measure since Σ; evidently fixed:—

	°	″	
Σ	P = 311·8	D = 21·98	1832·5
β	310·5	22·23	1878 5.

No. 362. Σ 2512.

The distance has greatly diminished, probably the result of proper motion:—

	°	″	
Σ	P = 18·3	D = 18·74	1829·2
DE.	22·5	14·60	1865·0
β	23·8	12·98	1878·6.

No. 363. Σ 2636.

Very decided motion, and probably binary. The following are all the observations:—

	°	″	
Σ	P = 35·5	D = 1·95	1831·2
MA.	37·3	1·86	1842·7
DE.	57·7	1·79	1865·6
β	64·5	1·76	1878·7.

No. 366. 54 *Sagittarii*. H. 599.

In one Catalogue H. called the small star 18 m. No change in the larger star. No other measures of B. For C we have:—

J.	P = 42°·2	D = 45″·59	1845·8
β	41·7	45·57	1878·7.

No. 367. Σ 2557. (AC = β 54.)

The small star was added with the 6-inch. There may be a small decrease in the distance of AB.

Σ	P = 104°·7	D = 11″·42	1831·8
DE.	104·5	11·14	1867·7
β	103·4	10·76	1878·5.

No. 368. Σ 2564.

Change is clearly shown.

Σ	P = 184°·0	D = 10″·78	1832·3
DE.	178·5	10·10	1866·3
β	175·1	10·04	1878·4.

No. 369. χ *Aquilæ*. OΣ 380.

There does not seem to be any material change in either the angle or distance, as will appear by the following:—

OΣ	P = 74°·8	D = 0″·62	1850·7
SE.	76·9	0·54	1858·0
DE.	69·4	obl.	1867·8
NE.	77·4	0·51	1874·7
β	74·6	0·64	1877·7.

OΣ measured a third star, 1″·2 distant in 1842, but it was not seen on several later nights. NE. could not find it with the 26-inch in 1874, and I saw no trace of it on any of these occasions, when the close pair was widely separated.

No. 370. OΣ 382.

A close and difficult pair, but thus far without sensible variation.

OΣ	P = 353°8	D = 0″48	1849·8
Dr.	173·7	obl.	1866·9
Nr.	357·5	0·42	1874·7
β	175·3	0·45	1878·5.

No. 371. Σ 2574.

Slow direct motion in angle and distance diminishing.

Σ	P = 129°4	D = 0″96	1832·2
Dr.	141·4	0·6	1866·3
β	145·0	0·63	1878·5.

No. 372. P. XIX. 257. A. G. C. 10. (AC = Σ 2570.)

The principal star of Σ 2570 was found by A. G. C. in 1875 to be a very close pair with an aperture of 12 inches. The distance cannot exceed 0″·25. I know of no other measures with which to compare my own. There is no change in Σ's companion. This star is very near *γ Aquilæ*.

No. 373. OΣ (App.) 190.

The large stars, A and C, make one of the list of wide couples given in the first edition of the Pulkowa Catalogue. The small star has not been before observed. The only measures of AB are :—

Dr.	P = 316°5	D = 67″60	1873·5
β	316·8	67·32	1878·4.

No. 374. *γ Aquilæ*.

The only earlier measure of the nearest of many stars in the field is given below. It is not in any Catalogue of double stars.

Mu.	P = 270°5	D = 49″08	1837.

No. 376. *ζ Sagittæ.* A. G. C. 11. (AC = Σ 2585.)

The duplicity of the large star was discovered by A. G. C. about the same time as Σ 2570, given above, and with the same aperture. There is no apparent change in the angle, but it was certainly a little wider in 1878 than the preceding year, and may become a moderately easy pair to measure in a few years. The mean result of the five measures is :—

	°	″	
β	P = 157·6	D = 0·29	1878·1.

There is no change in the ℍ and Σ star.

No. 377. B.A.C. 6814. H. 2904.

The angular change was sufficient to attract my attention from inspection, and it was measured on three nights with the 6-inch in 1875. The first measure by H. is from the Catalogue in which the star first appears, and the other a subsequent measure from his Eighth Catalogue:—

	°	″	
H.	P = 173·5	D = 20±	
H.	170·6	20±	1834·6
β	144·7	...	1875·1
O. S.	141·6	18·27	1877·7
β	140·8	18·39	1878·7.

No. 378. *β Aquilæ.* OΣ 532.

The two stars have a common proper motion and are probably physically connected:—

	°	″	
MU.	P = 23·8	D = 11·81	1838·8
OΣ	17·0	12·60	1858·1
DE.	17·8	11·98	1868·1
OΣ	15·6	12·67	1874·7
β	16·5	12·00	1878·6.

No. 379. β 425.

The small star, C, was added by De. when measuring AB. The following are all the measures of the close pair:—

De.	P = 241·3	D = 1·26	1876·3
β	240·2	1·32	1878·6.

No. 380. A.C. 16. (A and C = OΣ (App.) 195.)

Close pair discovered by A. C. in 1858. There is not much change since that time:—

Da.	P = 234·3	D = 0·35±	1859·6
De.	64·0	oval	1872·5
Ne.	241·4	0·45	1874·7
β	237·7	0·45	1878·7.

No. 381. *Cygni* 116. OΣ 392. (AC = Σ 2607.)

The principal star of Σ 2607 was found by OΣ in 1841 to be double. The following are all the measures:—

Ma.	P = 324·3	D = 0·2	1843·8
OΣ	322·0	0·44	1844·7
OΣ	317·1	0·43	1855·6
De.	306·9	...	1867·4
β	317·0	0·31	1878·5.

No material change in the third star, C, since Σ.

No. 382. χ *Sagittæ*. ℍ IV. 100.

ℍ gives the following description:—

AB	P = 259·6	D = 23·03	1783·6
AC	280·±	60·±	1783·6.

I have always supposed his AB to refer to two distant stars, about 23″ apart, and C to be χ itself. The angles and distance then all correspond

with the stars as they now appear. The star I have measured was first seen with the 6-inch, but is quite faint.

No. 385. Σ 2615.

There may be a little change in the angle, but the increase in distance as shown by the measure from the *Washington Observations*, 1867, is not confirmed by my measures.

		°	″	
Σ	P =	323·2	D = 10·82	1828·9
FERGUSON		321·6	11·84	1863·7
β		318·4	10·60	1878·5.

No. 386. Σ 2619.

The small star, C, is not in Σ. It was first noted by H., and subsequently by OΣ, who found it very faint in 1851. In 1854 another small star about 6″ from C was detected. This has not been measured. I did not notice it on this occasion, although it was not looked for. Σ's pair appears to be fixed. The only measures of AC are:—

		°	″	
OΣ	P =	299·6	D = 17·33	1862·8
β		294·2	18·40	1878·4.

No. 387. 26 *Cygni*. ℍ V. 47.

The small star, C, not before noted. No measures in ℍ of AB. For comparison we have only:—

		°	″	
DE.	P =	146·3	D = 41·60	1873·5
β		146·8	41·76	1878·4.

No. 391. OΣ 400.

Undoubtedly a binary system.

		°	″	
OΣ	P =	334·9	D = 0·64	1845·7
OΣ		324·6	0·59	1853·2
DE.		307·8	obl.	1866·7
SHP.		267·9	0·3±	1875·7
β		...	single	1878·6.

No. 392. Σ 2652.

If this was really single in 1863, it would tend to show a rapid binary system, and, as in 42 *Comæ*, with but little variation in the angle.

	°	″	
Σ	P = 283·2	D = 0·28	1836·5
OΣ	288·0	0·40	1845·6
Sᴇ.	278·9	0·3	1857·4
Dᴇ.	...	single	1863·9
β	269·9	0·42	1878·5.

No. 394. Σ 2658 = ♅ N. 72.

A decided change in both companions. For A and B we have :—

	°	″	
Σ	P = 126·9	D = 5·49	1831·6
Dᴇ.	123·0	5·45	1863·5
β	119·9	5·21	1878·6;

and for A and C :—

	°	″	
Σ	P = 216·8	D = 32·06	1832·1
Dᴇ.	213·2	37·80	1863·5
β	212·4	40·50	1878·6.

If the small star, C, is fixed, evidently A and B have a common proper motion.

No. 395. α^2 *Capricorni*. A. G. C. 12. (AB = H. 608.)

The duplicity of H.'s small companion, which in the first observation he called 16 m., was discovered by A. G. C. with the 18½-inch object-glass—now at the Dearborn Observatory—while it was in the possession of the makers. It is a beautiful object with a sufficient aperture. The only measures are the following:—

	°	″	
Hɴ. & Nᴇ.	P = 58·1	D = 1·48	1874·6
Hʟ.	245·2	1·14	1875·7
β	61·2	1·06	1878·5.

For A and BC we have:—

MH.	P = 144°·1	D = 6″·36	1846·7
β	150°·2	7″·41	1878·5.

The measure of MH. is a mean of 21 nights for distance, and 13 nights for angle.

No. 396. Σ 2662.

But little, if any, change. The single observation of SE. evidently has an error in the distance, perhaps 1″, or has reference to some other pair. These are the measures recorded:—

Σ	P = 38°·9	D = 1″·72	1831·0
MA.	39°·9	2″·00	1842·7
SE.	41°·3	0″·45	1856·6
W. S.	41°·7	...	1875·7
β	36°·6	1″·65	1878·5.

No. 397. ν *Capricorni.*

Not in any double star Catalogue, but noted in the *Munich Observations*. There is an error of 180° in the position angle.

MU.	P = 28°·0	D = 56″·33	1836
β	210°·1	55″·38	1877·8.

No. 398. ♅ N. 138.

Given in ♅ without measures as "Class I." Peters (A. N. 1635) picked it up when observing an asteroid, and measured it, 331°·8 : 4″·0. This is the only observation I have found. There is a small error in ♅'s place.

No. 401. 1 *Delphini.* β 63.

My measure of this is not good. The measure given below by DE. is a mean of 4 nights' observations (A. N. 2081), and that by NE. a single night:—

NE.	P = 350°·0	D = 0″·64	1874·7
DE.	342°·4	0″·86	1875·8
β	345°·0	1″·22	1878·4.

The minute star added with the Washington 26-inch (β 297) was not seen on this occasion.

No. 402. Σ 2690.

There is no evidence of change either in the wide pair, Σ 2690, or the close pair discovered by Da. The 16 m. star added by H. is given 121°·5 : 20″±, and no later measures. If this single observation can be depended upon, there would seem to be some change in the angle. The mean result of my measures is:—

	P = 108°·4	D = 23″·40	1878·2.

No. 403. Ma. 8.

From a short list of new pairs by Ma. The following are the only measures:—

Ma.	P = 249°·3	D = 18″·31	1843·8
β	248·4	19·13	1878·2.

No. 404. Σ 2703.

B remains fixed, but the distance of C has increased.

Σ	P = 217°·9	D = 54″·38	1829·4
Du.	217·4	57·03	1868·5
β	217·1	57·78	1878·7.

No 405. β *Delphini*. β 151.

There can be no doubt of the binary character of the close pair. When discovered in 1873 with the 6-inch it was a comparatively easy object. It has been gradually closing up since, and it is not likely that it will be measurable after the present year (1878) until the smaller star emerges in the opposite quadrant. It is now excessively difficult, requiring the best

atmospheric conditions. The following are the results of the observations for each year:—

	°	″		
β	P = 355·±	D = 0·7±	1873·6	Est.
De.	15·6	0·65	1874·6	4 Obs.
Ne.	13·6	0·49	1874·7	3 „
De.	20·1	0·54	1875·6	4 „
Shp.	15·1	0·4±	1875·8	5 „
De.	25·8	0·48	1876·6	4 „
De.	29·7	0·51	1877·7	5 „
β	40·8	0·32	1877·8	4 „
De.	59·2	obl.	1878·7	1 „
β	53·7	0·24	1878·6	4 „

The small star, C, is not in Σ. It was noted by H. with the angle 107°·7, and has not been measured since prior to my observations. The change in this and in D are due to proper motion.

No. 406. *κ Delphini.* OΣ 533.

All the prior measures of this pair are by OΣ and De., some of which are:—

	°	″	
OΣ	P = 12·4	D = 10·23	1851·6
OΣ	359·0	10·32	1859·6
De.	345·7	9·41	1868·1
OΣ	335·1	10·88	1874·8
De.	327·8	11·10	1877·7
β	329·2	10·59	1878·2.

No. 407. *α Delphini.* H. 1554.

C is H.'s nearest star, the angle of which he gives, 278°·0. With the Washington 26-inch I found a nearer star, but it was too difficult to measure when the more distant stars were observed.

No. 411. Σ 2720.

This is the only measure since Σ:—

	°	″	
Σ	P = 185·0	D = 3·81	1830·4
β	182·1	4·07	1878·7.

No. 413. *Cephei* 55. β 152.

The following is a mean of 5 nights by De.:—

	°	″	
De.	P = 111·0	D = 0·44	1876·0
β	112·3	0·55	1878·5.

No. 415. Σ 2734.

Change in angle and distance.

	°	″	
Σ	P = 181·7	D = 28·50	1829·8
De.	187·9	26·72	1863·5
β	191·2	25·82	1878·6.

No. 416. OΣ 418.

The only material change is in the distance.

	°	″	
OΣ	P = 301·8	D = 0·56	1842·7
Da.	115·9	0·61	1853·8
De.	292·4	1·01	1867·0
β	294·8	1·2±	1877·7.

No. 417. OΣ 419.

The measures do not indicate any great change.

	°	″	
OΣ	P = 40·0	D = 1·78	1847·1
De.	36·6	1·62	1866·2
β	38·0	1·65	1877·7.

No. 418. OΣ 424.

Appears to be a binary system in perhaps rapid motion, as De. found it single or doubtful in 1865. The following are all the measures:—

	°	″	
OΣ	P = 332·0	D = 0·46	1845·7
OΣ	325·5	0·46	1846·7
Ma.	145·6	0·25	1848·7
OΣ	318·9	0·36	1852·6
β	327·7	0·45	1878·6.

In 1876 I noted it as being absolutely round with the highest powers on the 6-inch aperture.

No. 419. H. 3006

The description in H. is, 300°± : ½″ : 10 m.; "a violent suspicion, which higher powers increase." I looked for this twice with the 6-inch without success. The distance is considerably greater than suspected by H., but that under the circumstances could hardly be taken as evidence of change.

No. 420. ℍ IV. 113 = H. 613 = Σ 2748 *rej.*

The faint star, C, was detected by Mr. I. W. WARD with an aperture of only 4·3 inches. It is a very faint object. For AB we have:—

	°	″	
ℍ	P = 298·4	D = 17·50	1783·7
DE.	299·5	18·77	1876·8
β	299·9	18·72	1878·5.

DE. calls AB gold and blue.

No. 421. Σ 2749.

The duplicity of Σ's companion was discovered by SE. in 1856. The few measures that have been made indicate rapid motion. No change in the wide pair:—

	°	″	
SE.	P = 127·6	D = 0·6	1856·6
DE.	141·7	0·8	1863·9
β	148·9	1·13	1877·8.

No. 423. OΣ 527.

It is not easy to reconcile some of the measures, but there has been some angular motion. The following are all the measures made of this pair. The observations of MA. are credited to OΣ 429; but that star is not double:—

	°	″	
OΣ	P = 306·2	D = 0·40	1846·8
MA.	314·4	0·45	1848·7
OΣ	295·1	0·33	1852·6
OΣ	290·6	0·46	1859·6
DE.	319·9	obl.	1869·8
β	285·0	0·52	1878·3.

The angles of MA. and DE. are increased 180° for convenience of comparison. I found the *p.* star manifestly the smallest.

No. 424. (Nebula and Star.)

This tolerably bright nebula was found with the 6-inch several years ago, and noted at the end of my third list of new double stars. As suspected there, it is double, and I have measured the distance between the centres of the two parts, and also the distance from a 9 m. star. There is an excessively faint star which, with the nebula and the 9 m. star, makes a nearly equilateral triangle.

No. 425. OΣ 429 *rej.*

This pair, at one time suspected to be double by OΣ, was rejected as single in the Catalogue of 1850, and found single later by DE. MA. has two measures of it, but there is no doubt whatever that he observed OΣ 527, which is in the immediate vicinity. These measures are given in the note to that star.

No. 427. *γ Equulei.* KN. 2.

The close star was discovered by KN. in 1867.

	°	″	
KN.	P = 276·8	D = 2·13	1867·5
β	274·5	2·16	1877·7.

The faint star, first noted with the 6-inch, has not been measured before.

No. 429. *δ Equulei.* OΣ 535.

One of the closest pairs, and thought by OΣ to be a binary of very short period. My single angle does not agree very well with the measures of OΣ, the most of the angles being about 200°. The following are the principal observations of OΣ. All other observers have measured only the wide pair (Σ 2777):—

°	″	
P = 191·9	D = 0·27	1853·9
...	single	1854–6
209·5	0·21	1857·7
236 ?	...	1861·6
24·0	elongated.	1874·6
1·8	wedged.	1874·7
221·2	0·33±	1874·7.

No. 430. τ *Cygni.* A. G. C. 13.

Discovered in 1874 by A. G. C. with the Washington 26-inch. There is an excessively faint star for which Hl. gives, 260°·3 : 15″·68 (1876·9). I could see this, but did not attempt measures. The close pair is in rapid movement, as will be seen from the following:—

		°	″	
	De.	P = 174·5	D = 1·24	1875·1
	De.	170·5	1·32	1875·7
	De.	161·5	1·24	1876·8
	Hl.	160·2	1·04	1876·9
	De.	155·3	1·26	1877·7
	β	150·0	1·06	1878·4.

No. 431. ν *Cygni.* OΣ 433 = H. 932.

No evidence of change.

		°	″	
A and B	OΣ	P = 220·1	D = 15·07	1849·5
	De.	219·9	15·06	1866·7
	β	218·5	14·77	1878·4
A and C	OΣ	177·5	21·20	1849·5
	De.	178·5	21·28	1866·7
	β	177·9	21·38	1878·4.

No. 432. β 289.

This triple was found by me with the Washington 26-inch in 1874. It is in a low power field with the preceding star, ν *Cygni.* I know of no other measures of it.

No. 433. OΣ 435.

Very little angular motion.

	°	″	
OΣ	P = 23·8	D = 0·60	1848·1
Da.	201·8	0·5±	1852·4
De.	196·2	obl.	1866·0
β	205·9	0·62	1878·7.

No. 434. *β Equulei.* H. 3023.

I have added the nearest star, B, which is much fainter than any of the H. companions. H. gives the angles of C, D, and E, respectively, 314°·4, 14°·5, and 278°·0

No. 435. 18 *Aquarii.* H. 5517.

H. notes, "a most minute point strongly suspected," 270° : 13″. I have examined this star many times, with my 6-inch, and the 9·4-inch of the Dartmouth College Observatory, prior to the present observation, but no suspicion at any time of any near companion, and I am confident nothing answering the description of H. exists. The nearest I could find I have measured.

No. 437. β 164. (AC = Σ 2793.)

The following are all the measures of the close pair:—

NE.	P = 244°·8	D = 0″·64	1874·7
DE.	241·3	0·56	1875·1
β	237·3	0·82	1877·7.

No. 438. β 72.

Near β *Aquarii*, and in the field with β 684.

DE.	P = 45°·2	D = 1″·82	1877·1
β	43·1	1·89	1878·1.

No. 439. β *Aquarii.* ♅ V. 76 = H. 936.

H. gives the angle 322°·8. The third star, C, was noted with the 6-inch.

No. 445. H. 947 = ♅ N. 74.

The only other measures are:—

P. SM.	P = 92°·5	D = 20″·32	1862·7
	323·6	21·74	1862·7.

No. 448. H. 3069. (AB = OΣ 453.)

H. did not detect the close pair, and OΣ has no observation of C. The description in H. is, 82°·9 : 25″±. The measures of OΣ and De. show no change in AB.

No. 449. OΣ 537.

One of the later additions to the Pulkowa list. OΣ has but one observation, the angle of which is 180° in error. At times I have found this very difficult with the 6-inch, and once or twice it was not seen at all. There seems to have been some change in the angle and distance since 1856. I know of no other measures:—

	°	″	
OΣ	P = 13·5	D = 2·57	1856·7
β	201·5	2·16	1878·6.

No. 450. OΣ 458.

In the field with the preceding pair. The minute star has not been observed before. I first noted it with the 9·4-inch of the Dartmouth College Observatory. There is no material change in the close pair:—

	°	″	
OΣ	P = 348·8	D = 0·71	1851·7
De.	353·7	0·80	1866·9
β	351·9	0·86	1878·6.

No. 451. AC = H. 5524.

B was discovered by Howe at Cincinnati, and measured, 270°·3 : 9 ·09 (1877·8). H. has no measures of AC.

No. 454. Σ 2860.

Very decided motion, apparently rectilinear.

	°	″	
Σ	P = 250·8	D = 3·32	1832·3
Ma.	252·4	4·45	1844·4
De.	254·6	5·15	1864·9
β	255·6	5·96	1878·5.

No. 455. OΣ 460.

The only measures of AB are:—

OΣ	P = 352°·2	D = 5′·78	1849·7
β	351·8	6·71	1877·8.

For AC we have:—

OΣ	P = 49°·1	D = 15″·95	1849·7
De.	46·7	15·77	1866·5
β	46·3	16·04	1877·8.

No. 457. OΣ 462.

Close pair appears to be without change. The small star has been measured before only by OΣ:—

OΣ	P = 33°·8	D = 7″·53	1850·0
β	31·0	6·95	1877·8.

No. 458. π^1 *Pegasi*.

The distant, C, is in Sm. I have measured also a smaller and nearer companion.

No. 459. *Pegasi* 129. Σ 2869.

The following are all the measures:—

Σ	P = 253°·7	D = 22″·74	1829·5
De.	252·9	21·09	1864·7
β	253·4	21·53	1878·4.

No. 460. Σ 2879.

Probably unchanged. Se. has one observation which evidently belongs to some other pair:—

Σ	P = 226°·2	D = 0″·79	1836·3
OΣ	228·8	0·85	1845·0
β	228·3	0·91	1878·7

No. 462. β 378.

AB was discovered with the 6-inch, and in measuring that pair a third star was added.

No. 463. 30 *Pegasi*. H. 962.

A fine object with a large aperture. H. measured only the angle of C, 212°·0. The only measures since are:—

		°	″	
A and B	DE.	P = 19·8	D = 6·18	1867·1
	HL.	19·0	6·30	1875·8
	β	18·6	6·22	1878·6
A and C	HL.	220·7	9·80	1875·8
	β	223·0	10·04	1878·6.

No. 464. γ *Aquarii*. H. 3106.

The only measures are:—

	°	″	
MU.	P = 125·9	D = 49·46	1838·8
β	129·6	43·87	1878·7.

No. 465. 51 *Aquarii*. β 172.

The measure of DE. is the mean result of 6 nights:—

	°	″	
DE.	P = 21·9	D = 0·44	1875·7
β	24·9	0·58	1878·2.

No. 466. 34 *Pegasi*. β 290.

Discovered at Washington in 1874. The only measures for comparison are:—

	°	″	
HL.	P = 223·3	D = 2·61	1875·7
β	218·6	2·62	1877·9.

No. 467. β 291.

A difficult pair within the triangle formed by 34, 35, and 37 *Pegasi*.

	°	″	
DE.	P = 157·8	D = 0·32	1875·8
β	160·0	0·42	1878·6.

No. 469. OΣ 471 *rej.*

Rejected as single by OΣ and so found by De. in 1866. Ma. has a measure, 6°·8 : 0″·22 (1843·6), but there is very little probability of this star being really double.

No. 47. 37 *Pegasi.* Σ 2912.

Binary, and now a very difficult pair. At the time of finding 34 *Pegasi* double with the Washington 26-inch, I could see no trace of duplicity in this star, and it was always single with the 6-inch. A few of the measures are:—

	°	″	
Σ	P = 115·6	D = 1·15	1835·6
Se.	117·6	0·74	1857·1
W. S.	122·3	...	1871·9
β	130·0	0·32	1878·6.

From the measures it would appear that it could not have been really single in 1874.

No. 471. Σ 2915.

A decided change in the angle.

	°	″	
Σ	P = 169·0	D = 12·27	1827·8
De.	158·8	12·20	1863·7
β	155·1	12·29	1877·8.

No. 473. *Aquarii* 215. Σ 2936.

No other late measures.

	°	″	
Σ	P = 47·1	D = 4·69	1832·2
β	50·8	4·92	1877·8.

No. 475. OΣ 477.

The change is probably due to proper motion.

	°	″	
OΣ	P = 122·7	D = 9·60	1846·1
De.	138·5	6·49	1867·1
OΣ	148·2	5·54	1875·7
β	154·1	4·62	1878·6.

No. 476. B.A.C. 7931. (AB = H. 1802 = Σ 2942 = OΣ 478.) (AC = β 450.)

The third star was found last year with this instrument. No material change in AB. The third star is quite a minute point.

No. 477. *ξ Pegasi.* H. 301.

There seems to be no doubt of angular motion.

	P	D	
H.	P = 122°·8	D = 15″±	1830·
DE.	117·7	12·17	1866·8
β	111·9	11·93	1878·6.

No. 479. H. 3152.

The description in H. is, 135°·4 : 3″± : 9 . . 15. "A very difficult object, measured with 320, which still left a suspicion of illusion, though I have hardly a doubt." I have looked for this many times, but without seeing the least trace of any companion.

No. 480. Σ 2954.

The following are all the measures :—

	P	D	
Σ	P = 28°·6	D = 36″·73	1830·9
DE.	27·0	37·94	1864·9
β	27·4	37·97	1877·8.

No. 481. β 383.

A and C discovered with the 6-inch, and B added with the large aperture.

No. 482. Σ 2959 = ♅ N. 15.

Evidently moving.

	P	D	
Σ	P = 96°·7	D = 15″·66	1832·1
DE.	101·7	14·21	1864·8
O. S.	101·5	14·14	1877·8
β	102·2	13·77	1877·8.

The third star, C, is new.

No. 483. B.A.C. 8001. OΣ 536.

The following are all the measures of this pair:—

	°	″	
OΣ	P = 344·	D = 0·33	1852·7
OΣ	332·8	0·40	1852·7
OΣ	343·7	0·46	1853·9
OΣ	...	single	1859·6
OΣ	260·?	...	1861·7
β	...	round	1874·8
β	161·5	0·47	1877·8.

No. 485. Σ 2976.

A and B relatively fixed, but rectilinear motion in C.

	°	″	
Σ	P = 177·7	D = 15·88	1828·4
Se.	183·2	16·31	1857·4
W. S.	187·0	16·5	1873·8
β	188·3	16·65	1878·2.

No. 486. Σ 2980.

The only measures are as follows:—

	°	″	
Σ	P = 107·9	D = 4·15	1831·1
O. S.	108·3	4·26	1877·9
β	111·8	4·38	1877·7.

Probably without change.

No. 490. *Aquarii* 286. β 181.

The close pair has been carefully observed by De. on 4 nights with the following result:—

	°	″	
De.	P = 309·2	D = 1·51	1876·3.

No. 491. ψ^1 *Aquarii.*

I have only measured two minute stars not in Σ.

No. 492. β 80.

De. has measured this on 4 nights, the mean result of which is given below. My angle is undoubtedly too large.

	°	″	
De.	P = 300·4	D = 1·07	1875·8
β	306·1	1·24	1877·8.

No. 493. 96 *Aquarii*. H. 5394.

Probably fixed.

	°	″	
H.	P = 26·3	D = 10±	1836·7
De.	23·5	9·88	1869·8
β	23·1	10·08	1878·6.

No. 496. 78 *Pegasi*. A. G. C. 14.

Discovered in 1875 by A. G. C. with a 12-inch aperture. De., by 4 measures, gives the following result:—

	°	″	
De.	P = 192·0	D = 1·45	1876·6
β	191·8	1·61	1878·8.

No. 498. OΣ 506 *rej.*

This was observed on account of the variation in distance shown by a single measure of Ma. My observations do not confirm such change:—

	°	″	
Ma.	P = 80·5	D = 16·67	1843·9
De.	79·9	17·93	1867·5
β	79·4	18·09	1877·8.

No. 501. β 281. (AC = H. 998.)

The close star was discovered by me with the 9·4-inch of the Dartmouth College Observatory. It has not been measured by De., and H. has no measures of C.

No. 502. Σ 3055.

The components are evidently relatively fixed.

	°	″	
Σ	P = 359·9	D = 5·67	1836·1
β	359·6	5·79	1878·6.

Note.

I ascertained, too late to make the correction in its proper place, that No. 562 of the list of new stars is identical with one of the close pairs of the Pulkowa Catalogue, OΣ 122. I have made a measure, which is given below with all the prior measures on record:—

MA.	P = 117·8	D = 0·22	1843·2
OΣ	108·9	0·36	1847·7
MA.	138·9	0·2	1852·3
β	117·7	0·29	1878·8.

The observations furnish very little evidence of motion.

I have made another and successful search for Σ 1058, and made two measures as follows:—

P = 281·0	D = 22·84	1879·184	Mags. 8 ...11
281·0	22·32	1879·200	8·5...11.

The principal star is Arg. (9°) 1497, and the place for 1880 is:—R.A. $7^h\ 10^m\ 17^s$; Decl. 9° 37′, agreeing almost exactly with *Mensuræ Micrometricæ*. It is not found in WEISSE or LALANDE. In ARGELANDER it is called 7–8 magnitude. It will be interesting to watch this pair, and see whether one of the components is variable. I had supposed my search in 1878 was a thorough one. In all similar cases heretofore the explanation has been found in errors of observers, and not in the disappearance, or change, in the stars themselves.

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Double Star Observations

made with the 36 inch refractor of the Lick Observatory by *S. W. Burnham.*

The double star observations which follow comprise that work with the 36 inch Clark refractor since the publication of my last list (A. N. 2875), and were principally made during the first four months of the present year. A few measures with the 12 inch telescope, which were omitted in the first series, are included in this list; but substantially all the measures have been made with the large refractor, as indicated in the last column of the Catalogue following.

The micrometer for the large telescope was made by Fauth, but after the Clark plan in all essential particulars; and, after some minor changes, was made to work most satisfactorily. The bright-wire illumination is very perfect; and no star or nebula which can be seen at all is too faint for measurement. The light is under perfect control, and can be instantly changed from the maximum brilliancy of the wires to invisibility. Either a part or all of the light, depending upon the object under observation, is passed through red glass before reaching the wires. The illustration and description of the Clark micrometer for the 12 inch refractor, with the device for a self-adjusting illuminating lamp, given in Monthly Notices for March, 1882, will apply equally well to the large micrometer.

The micrometer eye-pieces give powers (approximately) of 450, 670, 1000, 1350, 2000, 2700 and 3300. For very close pairs the last three were generally used when the air was sufficiently steady. In measuring very unequal pairs, with distances of 1".5 and upwards, the two lower powers have been usually employed. It did not seem worth while to indicate the particular power used in each of the measures.

The current double star number continued from my previous catalogues was inadvertently omitted from the list of new pairs in A. N. 2875. For convenience of reference hereafter, I have attached these numbers to the stars of that list, and carried them forward through the present Catalogue.

The several new pairs of the first list, and the mean results of the measures, are as follows:

β	Star	RA. 1880	Decl. 1880	Pos.	Dist.	Mags.		1880+	n	Remarks
1026	Lal. 58	$0^h\ 5^m48^s$	+52° 57′	329°.6	0".48	8.1	8.9	8.76	4	
1027	W_2 $0^h.200$	0 8 44	+20 50	186.8	1.54	7.2	10.3	8.82	3	
1028	γ Cassiopeiae	0 48 50	+60 1	255.9	2.18	—	11	8.69	6	
1029	ζ Piscium	1 7 27	+ 6 56	248.7	0.93	—	11	8.71	5	B and C
				63.5	23.72	—	—	8.71	5	A and B
1030	W_9 $3^h.5$	3 3 11	+21 17	164.6	0.58	8.4	8.4	8.83	3	
1031	Aldebaran	4 29 2	+16 16	281.1	2.34	9	12	8.81	3	C and D
				109.5	30.90	—	—	8.82	2	A and B
				34.9	116.91	—	—	8.81	3	A and C
1032	σ Orionis	5 32 43	— 2 40	357.0	0.26	4	6	8.81	4	A and B
				237.1	11.23	—	—	8.84	3	AB and C
				83.3	12.84	—	—	8.84	3	AB and D
				60.5	41.18	—	—	8.85	1	AB and E
1033	r^2 Sagittarii	18 47 51	—22 49	104.0	1.37	5.5	11	8.68	1	
1034	7 Aquarii	20 50 25	—10 9	165.0	2.09	6	11.7	8.68	5	
1035	B.A.C. 7422	21 17 16	—26 4	198.7	1.05	8	10.7	8.74	3	
1036	Yarnall 9529	21 40 59	—17 51	205.9	4.53	8	11	8.74	3	
1037	W_1 $22^h.854$	22 41 56	+12 22	224.4	0.66	8.7	10.8	8.81	3	
1038	DM. +41°.4881	23 45 31	+41 25	157.6	0.60	8.3	8.3	8.73	3	

In looking for new pairs, I have for the most part examined only naked eye-stars; hence, the large proportion of bright stars. Comparatively little time has been given to the discovery of new objects; in fact, I have purposely avoided finding them any faster than they could be thoroughly measured, and have rejected many new pairs among the smaller stars which incidentally came into the field. As far as possible, at least three measures have been

made of each pair, new and otherwise. The present work comprises about 400 measures of both classes of stars. This, under the circumstances, is perhaps as much as could be expected, taking into account the season, which here is the most unfavorable part of the year; that many clear nights are unsuitable for this kind of work; that one evening each week the telescope is at the service of visitors, and during a portion of the time is in use for other astronomical work; and the further fact that much time is required to handle and set so large a telescope.

New Double Stars

discovered with the 36 inch refractor of the Lick Observatory.

β 1039. Lal. 6084.
RA. $3^h 10^m 59^s$ Decl. +7° 13′.

1888.911	211°.8	1″.48	7 , 13	36
8.914	208.2	1.97	7 , 13	36
9.093	208.3	2.17	7 , 13	36
1889.00	209.4	1.87	7 , 13	

β 1040. Lal. 6591.
RA. $3^h 28^m 48^s$ Decl. +29° 37′.

1888.906	338.1	3.38	8 , 12	36
.911	337.0	3.76	8 , 11.5	36
.928	335.8	3.47	8 , 11.5	36
1888.91	337.0	3.54	8 , 11.7	

The magnitude in DM. is 7.4.

β 1041. W_2 3^h793, 798.
RA. $3^h 37^m 9^s$ Decl. +27° 26′.

A and B.

1888.906	39.9	123.49	7 , 7	36
.911	39.8	123.68	— , —	36
.928	39.9	123.54	7 , 7	36
1888.91	39.9	123.57	7 , 7	

B and C.

1888.906	349.4	7.76	-- , 13	36
.911	346.0	7.86	— , 12.5	36
.928	348.0	7.99	— , 13	36
1888.91	347.8	7.87	— , 12.8	

The wide pair is *OΣ* (App.) 38. I know of only the following measures:

1874.22 38°.2 122″.50 *A* 3 n 6.2, 6.3.

β 1042. Lal. 2372.
RA. $3^h 52^m 36^s$ Decl. −3° 0′.

A and B.

1888.911	94.0	55.04	7.5 , —	36
.914	93.6	—	— , —	36
.922	93.9	54.75	— , —	36
.928	93.7	55.01	7.5 , —	36
1888.92	93.8	54.93	7.5 , —	

B and C.

1888.911	39.3	1.17	9 , 10	36
.914	32.5	1.12	— , —	36
.922	34.6	1.04	8.7 , 9.5	36
.928	34.0	1.03	8.5 , 9.0	36
1888.92	35.1	1.09	8.7 , 9.5	

β 1043. 3 Camelopardali.
RA. $4^h 30^m 28^s$ Decl. +52° 50′.

1888.922	297°.0	4″.06	5 , 11	36
.925	296.4	3.79	— , 12	36
.928	298.5	3.92	— , 12	36
1888.92	297.3	3.92	— , 12	

β 1044. DM. +16°.637.
RA. $4^h 33^m 0^s$ Decl. +16° 16′.

This faint and rather difficult pair was found with 12 inch. It is $3^m 58^s$ following Aldebaran.

1888.900	217.3	1.13	9 , 11	36
.906	220.1	1.01	9 , 11	36
.911	218.1	0.94	9 , 11	36
1888.91	218.5	1.03	9 , 11	

β 1045. 99 Tauri.
RA. $4^h 50^m 32^s$ Decl. +23° 46′.

1889.091	6.1	6.28	6 , 12.5	36
.093	6.5	6.26	6 , 12	36
.099	5.9	6.37	6 , 12.5	36
1889.09	6.2	6.30	6 , 12.3	

β 1046. 9 Aurigae.
RA. $4^h 56^m 59^s$ Decl. +51° 26′.

A and B.

1888.922	94.7	6.21	5.5 , 13	36
.925	93.5	6.39	— , 13	36
.928	93.2	6.27	— , 12	36
1888.92	93.8	6.29	5.5 , 12.7	

A and C (= H_1 VI.35).

1888.922	60.8	89.91	—, 9	
.928	60.9	89.94	—, 9	
1888.92	60.8	89.92	—, 9	

The wide pair has not been measured before since it was entered by Herschel more than a century ago. His measures are:

1783.30 62.2 79.50.

β 1047. Aurigae 47.
RA. $5^h 2^m 13^s$ Decl. +27° 53′.

The smaller component of this pair is a close and difficult double, and might be easily overlooked by instruments of moderate aperture.

B and C.

1889.091	76°.3	0".37	9 , 9.3	36
.093	74.5	0.40	8.7 , 9.5	36
.104	75.2	0.54	8.5 , 8.8	36
1889.09	75.3	0.44	8.7 , 9.2	

A and BC (= Σ 645).

1889.091	26.8	11.60	7.5 , —	36
.093	26.2	11.79	7.0 , —	36
.104	26.7	11.68	7.0 , —	36
1889.09	26.6	11.69	7.2 , —	

The wide pair was first observed by Herschel. There does not seem to be any change in angle or distance.

1783.74	26°.0	13".60	H_1
1829.90	26.8	11.71	Σ.

Herschel's distance is probably too large.

β 1048. Lal. 10437.

RA. $5^h\,26^m37^s$ Decl. −1° 41′.

1889.128	359.0	2.29	6 , 10.5	36
.131	357.3	2.14	6.5 , 11	36
.134	358.4	2.18	— , —	36
1889.13	358.2	2.20	6.2 , 10.7	

In Heis 6m, and U.A. 6½.

β 1049. Σ 734.

RA. $5^h\,27^m3^s$ Decl. −1° 48′.

C and D (new).

1888.906	295.2	0.83	9 , 10	36
.911	298.5	0.78	— , —	36
.914	296.6	0.69	8.5 , 9	36
.928	294.3	0.74	8.5 , 9	36
1888.91	296.1	0.76	8.7 , 9.7	

A and B (Σ 734).

1888.906	355.0	1.68	— , —	36
.911	352.6	1.59	— , —	36
.914	357.3	1.66	— , —	36
.928	355.9	1.53	7 , 8	36
1888.91	355.2	1.61	7 , 8	

A and C (H_1 V. 119).

1888.906	242.8	29.53	— , —	36
.911	242.5	29.45	— , —	36
.928	243.1	29.28	— , —	36
1888.91	242.8	29.42	— , —	

The old stars seem to be relatively fixed. Some of the prior measures are:

1832.93	356°.4	1".78	A and B	Σ
1878.99	354.9	1.75		β
1783.76	248.4	30.20	A and C	H_1
1832.48	243.1	29.29		Σ
1879.02	242.9	29.47		β.

β 1050. Bond 974.

RA. $5^h\,30^m55^s$ Decl. −5° 33′.

1888.928	283°.0	0".64	— , —	36
9.077	284.4	0.62	10.5, 12	36
9.091	283.5	0.75	10.5, 11.5	36
1889.03	283.6	0.67	10.5, 11.7	

A difficult pair of small stars in the nebula of Orion.

β 1051. Bond 1096.

RA. $5^h\,32^m1^s$ Decl. −4° 57′.

1889.077	22.6	0.82	10 , 10.7	36
.091	25.3	0.73	9.8 , 10.5	36
.093	26.2	0.71	10.5, 10.8	36
1889.09	24.7	0.75	10.1, 10.7	

Another difficult pair in the nebula of Orion. It is Nr. 1096 of Bond's Catalogue. A star $7^1/_2{}^m$ p 22°.4, and 2′ 34″ n.

β 1052. Lal. 10776.

RA. $5^h\,35^m39^s$ Decl. −2° 57′.

1889.134	192.0	0.62	7 , 8	36
.137	189.4	0.59	7 , 8	36
.142	185.8	0.77	$6^1/_2$, $7^1/_2$	36
1889.14	189.1	0.66	7.2 , 8.2	

In U.A. 6.7m.

β 1053. Aurigae 146.

RA. $5^h\,45^m18^s$ Decl. +37° 19′

1889.922	283.2	0.43	7.5 , 9.5	36

β 1054. 136 Tauri.

RA. $5^h\,45^m47^s$ Decl. +27° 35′.

1889.060	234.1	14.78	5–6 , 11	36
.091	231.3	15.21	6 , 12	36
.099	231.2	15.02	6 , 12	36
1889.08	232.2	15.00	6 , 12	

β 1055. Aurigae 161 = B.A.C. 1899.

RA. $5^h\,51^m32^s$ Decl. +44° 35′.

A and B.

1888.922	332.9	1.49	6.5 , —	36
.925	328.4	1.46	7 , 11	36
.928	337.3	1.88	— , 12	36
1888.92	332.9	1.61	6.7 , 11.5	

A and C (= H_1 V. 91).

1888.922	327.0	33.36	— , —	36
.925	330.3	33.45	— , 9	36
.928	331.7	33.25	— , 9.5	36
1888.92	329.7	33.35	— , 9.2	

Like many others of this class, this pair has been wholly neglected since it was observed by Herschel more than one hundred years ago. The change, if any, is probably due to proper motion. Herschel gives:

1783.49	315°.1	30".05	H_1 1 n.

β 1056. μ Orionis.

RA. $5^h 55^m 47^s$ Decl. $+9° 39'$.

1889.104	271°.6	16".78	4 , 14	36
.110	273.9	16.73	—, 14	36
.115	272.0	16.89	—, 13	36
1889.11	272.0	16.80	—, 14	

β 1057. Aurigae 183.

RA. $5^h 58^m 42^s$ Decl. $+29° 32'$.

1889.091	209.5	10.06	6.3, 11.5	36
.099	209.8	9.89	6.3, 11.0	36
.104	209.0	10.00	6.3, 11.0	36
1889.10	209.5	9.98	6.3, 11.2	

β 1058. 4 Geminorum.

RA. $6^h 3^m 13^s$ Decl. $+23° 1'$.

1889.102	107.4	0.49	7.8, 7.8	36
.154	101.3	0.33	6.7, 7.2	36
1889.13	104.3	0.41	7.2, 7.5	

An occultation of this star by Jupiter, Nov. 7, 1882, was observed by Wilson at the Cincinnati Observatory, and singularly no gradual diminution of light was noticed. In a pair of this kind, with the present angle and distance, the change should have been apparent.

β 1059. μ Geminorum.

RA. $6^h 15^m 42^s$ Decl. $+22° 34'$.

A distant double companion. There are many faint stars less distant from the bright star.

B and C.

1889.091	265.6	0.80	10 , 10.7	36
.099	266.7	0.78	9 , 10	36
.104	267.9	0.81	10.5, 11.5	36
1889.10	266.7	0.80	9.8, 10.7	

A and BC.

1889.091	141.1	122.68	3 , —	36
.099	141.0	122.34	—, —	36
.104	141.0	122.46	3 , —	36
1889.10	141.0	122.49	3 , —	

β 1060. Lal. 13491.

RA. $6^h 52^m 38^s$ Decl. $+3° 46'$.

1889.154	56.5	3.17	7 , 12	36
.157	60.2	2.86	7 , 12	36
1889.15	58.3	3.01	7 , 12	

Large star reddish.

β 1061. $\varkappa$ Argus.

RA. $7^h 33^m 55^s$ Decl. $-26° 32'$.

A and B (= H_1 III.27).

1889.110	318.8	10.02	4 , 4	36
.115	317.6	10.10	4 , 4	36
.131	319.0	9.83	4.5, 4.5	36
1889.12	318.5	9.98	4.1, 4.1	

B and C.

1889.110	229°.8	6".53	—, 13	36
.115	227.3	6.24	—, 14	36
.131	230.7	6.62	—, 14.5	36
1889.12	229.3	6.46	—, 13.8	

The new star is rather difficult under ordinary conditions in this latitude. Change in the bright pair is uncertain.

β 1062. 82 Geminorum.

RA. $7^h 41^m 23^s$ Decl. $+23° 26'$.

1889.102	32.8	4.19	6 , 13	36
.104	34.4	3.92	—, —	36
.107	29.6	4.08	6 , 14	36
1889.10	32.3	4.06	6 , 13.5	

β 1063. ξ Argus.

RA. $7^h 44^m 15^s$ Decl. $-24° 34'$.

1889.110	189.7	4.65	4 , 13	36
.114	186.8	4.56	$3\frac{1}{2}$, 14	36
.131	189.5	4.69	—, 14.5	36
1889.12	188.7	4.63	—, 13.8	

Very faint star at this altitude.

β 1064. 19 Argus.

RA. $8^h 5^m 39^s$ Decl. $-12° 34'$.

A and B.

1889.049	245.7	1.72	6 , 12	36
.077	242.7	1.70	6 , 12	36
.091	245.7	2.14	6 , 13	36
.093	245.6	1.80	6 , 13	36
1889.08	244.9	1.84	6 , 12.5	

A and C (= H_1 IV. 26).

1889.060	255.7	70.96	6 , 9	36
.077	255.7	70.29	—, 9	36
.091	255.9	70.78	—, 9	36
1889.08	255.8	70.68	—, 9	

Herschel did not measure the wide pair, but it was observed later, and appears as No. 91 of South and Herschel's Catalogue of double stars. That is the only measure previous to the above.

1826.60 256°.0 70".17 Sh.

β 1065. β Cancri.

RA. $8^h 10^m 0^s$ Decl. $+9° 33'$.

1889.104	295.2	29.40	3 , 14	36
.107	294.8	29.43	4 , 14	36
.131	294.1	28.59	—, —	36
1889.11	294.7	29.14	$3\frac{1}{2}$, 14	

β 1066. Lal. 16489.

R.A. $8^h 18^m 31^s$ Decl. +9° 49′.

1889.107	189°5	2″50	6.5, 13	36
.131	188.9	2.19	7, 13.5	36
.134	184.6	2.06	7, 13	36
1889.12	187.7	2.25	6.8, 13.2	

The magnitude in DM. is 7.6

β 1067. *o* Ursae Majoris.

R.A. $8^h 20^m 17^s$ Decl. +61° 7′.

1889.142	192.9	6.67	3½, 15.5	36
.251	191.6	7.01	—, 15	36
.285	189.8	7.34	—, 15	36
1889.22	191.4	7.01	3½, 15.2	

An exceedingly faint companion, and difficult to measure except with a steady air.

β 1068. Lal. 17381.

R.A. $8^h 43^m 1^s$ Decl. +9° 19′.

A and B.

1889.131	190.3	0.50	7.5, 8.0	36
.151	193.0	0.42	8, 10	36
.288	186.3	0.44	7.5, 8.5	36
1889.19	189.9	0.45	7.7, 8.8	

AB and C.

1889.131	312.8	17.74	—, 12	36
.151	313.2	17.87	—, 13.5	36
1889.14	313.0	17.80	—, 12.8	

β 1069. Lal. 17416.

R.A. $8^h 43^m 40^s$ Decl. −10° 34′.

1889.097	61.6	2.02	6, 11	36
.091	59.5	2.40	7, 11	36
.093	61.3	1.98	6.8, 11	36
1889.09	60.8	2.13	6.6, 11	

β 1070. DM. +26°1940.

R.A. $9^h 17^m 13^s$ Decl. +26° 46′.

1889.107	70.4	0.57	8.8, 9.5	36
.134	78.0	0.53	9, 10	36
.151	67.1	0.41	9.5, 11	36
1889.13	71.8	0.50	9.1, 10.2	

This difficult pair of small stars was noted in measuring *x* Leonis (β 105). It is 27ˢ f, and 4′ n of that star. The magnitude in DM. is 8.8.

β 1071. *θ* Ursae Majoris.

R.A. $9^h 25^m 50^s$ Decl. +52° 11′.

1889.151	74.9	5.42	3, 14	36
.247	72.6	4.76	—, 13.5	36
.285	77.2	5.10	—, 13.5	36
1889.23	74.9	5.09	3, 13.7	

A very faint attendant, requiring good seeing to measure. As the proper motion of the bright star is about 1″12 in the direction of 240°, the distance of the companion, if not a physical pair, will increase by nearly that amount annually.

β 1072. Sh. 110.

R.A. $9^h 58^m 20^s$ Decl. −17° 31′.

A and B.

1889.115	42°5	10″93	—, 12	36
.131	42.2	10.81	—, 12	36
.151	43.1	10.95	—, 13	36
1889.13	42.6	10.90	—, 12.3	

A and C (= Sh. 110).

1889.115	272.8	21.28	7, 7.2	36
.131	273.1	21.30	7, 7	36
.151	273.7	21.11	6.8, 7	36
1889.13	273.2	21.23	6.9, 7.1	

From a comparison with the only other measure made of the bright stars, it would seem that there has been no relative movement.

1823.34 272°7 21″49 Sh.

β 1073. Sextantis 101.

R.A. $10^h 26^m 26^s$ Decl. −5° 27′.

1889.291	49.7	2.90	7, 11.5	36
.293	46.5	3.12	7, 11.5	36
.296	44.7	3.04	6.8, 11.5	36
1889.29	46.9	3.02	7, 11.5	

This star is $6\frac{1}{2}^m$ in Lalande (Lal. 20428), and $7^m.2$ in SD.

β 1074. Lal. 20453.

R.A. $10^h 28^m 20^s$ Decl. +46° 26′.

1889.249	209.7	2.28	6, 11.5	36
.285	204.7	2.19	7, 11	36
.291	210.8	1.84	6.3, 11	36
1889.27	208.4	2.10	6.4, 11.2	

β 1075. φ^3 Hydrae.

R.A. $10^h 30^m 25^s$ Decl. −15° 43′.

1889.131	277.4	3.00	6, 13	36
.134	275.8	3.07	6, 13	36
.151	278.1	3.02	6, 13	36
1889.14	277.1	3.03	6, 13	

β 1076. 55 Leonis.

R.A. $10^h 49^m 32^s$ Decl. +1° 23′.

1889.258	53.4	1.14	6, 10	36
.285	48.5	0.84	5.5, 10	36
.288	47.2	0.98	6, 11	36
1889.28	49.7	0.99	5.8, 10.3	

β 1077. α Ursae Majoris.
RA. 10h56m19s Decl. +62° 24'.

1889.142	327°0	0".96	2 , 11	36
.151	325.9	0.83	—, 11	36
.227	326.3	0.77	—, 11.5	36
.247	325.1	1.08	—, 11	36
1889.19	326.1	0.91	2 , 11.1	

A good exemple of a very unequal, and moderately close pair. It is a difficult object to measure with the large telescope except under very favorable conditions. It can hardly fail to prove to be a physical pair.

β 1078. Crateris 79 = Lal. 22102.
RA. 11h33m46s Decl. —13° 48'.

1889.293	50.8	8.19	6 , 13	36
.296	49.4	8.17	6.5, 11.5	36
.302	49.1	8.30	6.5, 12	36
1889.30	49.8	8.22	6.3, 12.2	

β 1079. Lal. 22586.
RA. 11h54m34s Decl. —21° 7'.

1889.293	148.0	11.59	6 , 13.5	36
.296	148.0	11.87	6 , 13.5	36
.302	147.7	11.62	6.5, 13	36
1889.30	147.9	11.69	6.2, 13.3	

β 1080. 17 Comae.
RA. 12h22m55s Decl. +26°35'.

A and B (= Σ 21 App. I).

1889.093	250.2	145.23	—, —	36
.107	250.4	144.87	—, —	36
1889.10	250.3	145.05	—, —	

B and C.

1889.093	156.8	2.01	—, 13.5	36
.107	157.8	1.59	—, 14	36
.131	155.9	1.78	—, 13.5	36
1889.11	156.8	1.79	—, 13.7	

The new star is very minute, and, like many other stars of the same class, given in this catalogue, will require a large aperture to satisfactorily measure it. The bright stars have remained substantially unchanged since the first measures.

1836.43	250°7	145".35	Σ
1877.77	250.4	145.38	Je.

β 1081. 37 Comae.
RA. 12h54m32s Decl. +31° 26'.

1889.107	351.8	5.07	4.5, 14	36
.134	351.6	5.21	—, 13.5	36
.151	350.6	5.17	—, 14	36
1889.13	351.3	5.15	—, 13.8	

Very much like the last pair except in distance.

β 1082. 78 Ursae Majoris.
RA. 12h55m35s Decl. +57° 1'.

1889.142	76°7	1".19	6 , 9.5	36
.151	74.7	1.45	5.7, 10.5	36
.154	74.3	1.58	5.5, 10	36
.173	70.4	1.44	6 , 9	12
.175	75.0	1.63	6 , 9.5	12
.247	76.3	1.71	6 , 9	36
1889.17	74.6	1.50	6 , 9.6	

It is singular that so easy a pair should have been overlooked heretofore. A 6 inch aperture would probably show it.

β 1083. Pi. 12h268.
RA. 13h0m27s Decl. +29° 40'.

B and C.

1889.093	236.3	0.47	11 , 11.5	36
.107	237.4	0.47	11.5, 11.5	36
.131	238.1	0.53	12 , 12	36
1889.11	237.3	0.49	11.5, 11.7	

A and BC (= H_2 2638).

1889.093	220.4	5.97	6.5, —	36
.107	221.3	6.46	6 , —	36
.131	217.9	6.26	7 , —	36
1889.11	219.9	6.23	6.5, —	

The new pair is a very difficult object, and was therefore missed by me in measuring Herschel's companion with the Chicago 18½ inch. With good seeing it is a beautiful triple star with the large telescope. As one star the companion was seen with difficulty in 1874 with the 6 inch. Herschel also noted a more distant star not measured above. The following are all the prior measures:

1831	209°6	6"±	H_2 1 n AB
1878.42	218.9	6.54	β 1 n
1831	6.0	20 ±	H_2 1 n AD
1878.42	7.2	40.28	β 1 n.

β 1084. W_1 13h235.
RA. 13h15m58s Decl. —4° 2'.

1889.302	87.9	2.70	7 , 12	36
.312	90.0	2.64	7.3, 13	36
.323	91.5	2.72	7 , 13	36
1889.31	89.8	2.69	7.1, 12.7	

β 1085. Taylor 6986.
RA. 14h52m34s Decl. —4° 30'.

1889.296	18.0	9.19	6, 13.5	36
.302	20.6	9.52	6, 13	36
.312	20.0	9.31	6, 13	36
1889.30	19.5	9.34	6, 13.2	

β 1086. 47 Bootis.

RA. $15^h 1^m 27^s$ Decl. +43° 37′.

1889.154	256°.4	6".16	5½, 13	36
.227	257.1	6.01	—, 13.5	36
.244	256.2	5.93	—, 13	36
1889.21	256.6	6.03	5½, 13.2	

β 1087. τ Coronae.

RA. $16^h 4^m 35^s$ Decl. +36° 46′.

1889.154	166.8	3.03	5½, 14	36
.227	171.2	3.22	—, 14	36
.244	169.4	3.07	—, 13.5	36
1889.21	169.1	3.11	5½, 13.8	

Similar to the last, but more difficult. The distance of the companion, if not connected with the primary, should increase about one-third of a second annually, from the proper motion of the bright star, which is 0".34 in the direction of 348°.

β 1088. μ Draconis.

RA. $17^h 2^m 51^s$ Decl. +54° 38′.

B and C.

1889.244	191.4	12.26	—, 13.5	36
.285	190.0	12.31	—, 12.5	36
.288	191.3	12.19	—, 13	36
1889.27	190.9	12.25	—, 13	

A and B (= Σ 2130).

1889.244	159.7	2.42	5½, 5½	36
.258	159.6	2.30	—, —	36
.285	158.9	2.53	—, —	36
.288	159.5	2.37	—, —	36
1889.27	159.4	2.40	—, —	

Future observations will show whether the new star belongs to the binary system. It is much easier than many of the faint companions given in this list.

β 1089. Y. 7220.

RA. $17^h 23^m 22^s$ Decl. −5° 49′.

1888.600	4.8	1.20	7, 11	12
.636	7.2	0.91	6½, 11	12
.681	3.5	0.75	7, 11	12
1888.64	5.2	0.95	6.8, 11	

Found with the 12 inch, and inadvertently omitted from the list in A.N. 2875.

β 1090. β Draconis.

RA. $17^h 27^m 43^s$ Decl. +52° 23′.

1889.227	11.8	4.01	3, 15	36
.244	15.7	4.00	—, 15	36
.288	12.0	3.75	—, 15	36
.293	13.9	4.12	—, 14.5	36
1889.26	13.4	3.97	—, 14	

The companion is a very minute point, but well seen under proper conditions. If not a physical pair, the position-angle should increase from the proper motion of the bright star.

β 1091. Lal. 33592.

RA. $18^h 8^m 35^s$ Decl. +38° 34′.

1888.782	40.8	0.53	8.5, 8.5	12
.785	35.5	0.53	8.7, 8.7	12
1888.78	38.1	0.53	8.6, 8.6	

β 1092. Rad. 5777.

RA. $22^h 33^m 3^s$ Decl. +72° 15′.

A and B (new).

1889.293	240.9	0.29	7.5, 7.5	36
.312	233.3	0.36	7.5, 7.5	36
1889.30	237.1	0.32	7.5, 7.5	

AB and D.

1889.293	137.1	42.05	—, 7.5	36
.312	137.7	42.09	7, 7	36
.323	137.5	42.37	7.5, 7	36
1889.31	137.4	42.17	7.2, 7.2	

AB and C.

1889.293	263.9	29.24	—, 12.5	36
.312	264.3	29.15	—, 12	36
.323	263.7	29.18	—, 12	36
1889.31	264.0	29.19	—, 12.2	

This has long been known as a very wide double (= H_1V. 94 = H_2 3133 = *OΣ* App. 236). The large telescope shows the preceding bright star to be a close double. The fainter star, C, is not mentioned by H_1 and *OΣ*, but given in H_2 3133, and with an error of 90° in the position angle of D. The place in H_1 V. 94 has an error of 7^m RA. and 29′ Decl. The bright stars are evidently fixed relatively. The following are all the prior measures:

1783.20	135°.2	41".67	H_1	1 n
1875.13	137.6	42.18	*Δ*	3 n
1883.18	137.7	42.19	Franz	5 n.

The following star is Rad. 5779.

Measures of Double Stars.

β 734. Ceti 132.

RA. $0^h 46^m 47^s$ Decl. $-24° 39'$.

1888.838	347°4	10".66	7 , 10	12
.851	346.4	11.01	—, —	12
1888.84	346.9	10.83	7 , 10	

Apparently unchanged:

1879.68 348°9 10".74 β 3 n.

Polaris.

RA. $1^h 13^m 45^s$ Decl. $+88° 40'$.

1889.293. Carefully examined with the 36 inch with various powers. Both stars single, and no companion nearer than the Σ star.

A. C. 2. 95 Ceti.

RA. $3^h 12^m 12^s$ Decl. $-1° 22'$.

1888.720	104.4	0.53	6 , 8	12
.818	121.2	0.37	6 , 9	36
1888.77	112.8	0.45	6 , 8.5	

Extremely difficult. Heretofore I have always found it single. No measures since the following:

1854.81 73°1 0".7 ± Da. 3 n.

Σ 566. 2 Camelopardali.

RA. $4^h 30^m 27^s$ Decl. $+53° 14'$.

A and B.

1888.922	292.4	1.62	—, —	36
.925	291.8	1.57	—, —	36
.928	291.4	1.54	—, —	36
1888.92	291.9	1.58	—, —	

A and C.

1888.922	210.6	23.47	—, 13	36
.925	209.6	24.17	—, 13	36
.928	209.3	23.43	—, 13.5	36
1888.92	209.8	23.66	—, 13.2	

A star near this, 3 Camelopardali, was found to be a new pair, and this pair was measured after observing the other. The faint star, C, has not been seen heretofore. The slow retrograde motion of the close pair continues.

β 314. Leporis 3.

RA. $4^h 53^m 39^s$ Decl. $-16° 34'$.

A and B.

1889.115	327.5	1.09	6 , 8	36
.134	324.8	1.06	6.8 , 8.5	36
.137	328.3	0.99	6.8 , 8.5	36
1889.13	326.9	1.05	6.5 , 8.3	

A and C.

1889.115	28°8	54".63	—, 9	36
.134	29.2	54.27	—, 7.5	36
1889.13	29.0	54.45	—, 8.2	

Change doubtful but perhaps distance increasing. In three of the measures by Δ the angle is reversed.

1876.69 149°9 0".43 Δ 4 n.

No other measures of the distant star.

β 555. β Orionis.

RA. $5^h 8^m 47^s$ Decl. $-8° 20'$.

1889.093. The small star appeared to have no certain elongation with the highest powers on the 36 inch. The fact that this star has appeared to be round for several years with apertures up to $18\frac{1}{2}$ inches would suggest a possible mistake in the suspected duplicity, although at the time there seemed to be no doubt of the well known companion being a very close pair. However, it should be carefully watched since it may be in rapid motion.

Σ 719.

RA. $5^h 22^m 27^s$ Decl. $+29° 27'$.

A and B.

1889.096	334.6	1.03	6.5 , 9	36

A and C.

1889.096	351.4	15.16	—, 8.5	36

Σ 728. 32 Orionis.

RA. $5^h 24^m 22^s$ Decl. $+5° 51'$.

1888.856	175.8	0.35	4 , 6	36
9.110	183.6	0.36	5 , 6	36
9.134	178.2	0.44	5 , 6	36
1889.03	179.2	0.38	4.7 , 6	

This well known binary has now become a very difficult pair.

θ Orionis.

RA. $5^h 29^m 23^s$ Decl. $-5° 28'$.

A and B.

1888.862	31.8	8.66	—, —	36
.879	32.3	8 86	—, —	36
.895	32.7	8.70	—, —	36
1888.88	32.3	8.74	—, —	

A and C.

1888.862	131.5	13.00	—, —	36
.879	131.2	13.06	—, —	36
.895	131.1	12.79	—, —	36
1888.88	131.3	12.95	—, —	

D and C.

1888.856	240°7	13″23	—, —	36
.862	240.1	13.48	—, —	36
.879	241.1	13.35	—, —	36
1888.87	240.6	13.35	—, —	

D and B.

1888.862	299.4	19.35	—, —	36
.879	299 4	19 33	—, —	36
.895	299.7	19.50	—, —	36
1888.88	299.5	19.39	—, —	

B and C.

1888.862	162.9	16.87	—, —	36
.879	163.3	16.70	—, —	36
.895	162.7	16.71	—, —	36
1888.88	163.0	16.76	—, —	

A and D.

1888.862	95.3	21.57	—, —	36
.879	95.5	21.55	—, —	36
.895	95.4	21.54	—, —	36
1888.88	95.4	21.55	—, —	

A and E (Fifth star).

1888.862	352.0	4.28	—, —	36
.879	352.4	4.30	—, —	36
.895	350.1	4.36	—, —	36
1888.88	351.5	4.31	—, —	

C and F (Sixth star).

1888.854	121.3	4.05	—, —	36
.856	121.8	4.06	—, —	36
.862	119.5	3.86	—, —	36
1888.86	120.9	3.99	—, —	

Soon after the large telescope was mounted, Mr. Alvan G. Clark discovered a very faint star within the trapezium. It is a difficult object with the 36 inch, and certainly has never been seen before, notwithstanding the numerous alleged discoveries with telescopes down to three or four inches aperture. Not less than a dozen of these imaginary stars have been distributed about the interior of the trapezium, and some of them noted with instruments which failed to show the fifth and sixth stars. Mr. Sadler has given a diagram of these stars so far as they can be located from the rather vague descriptions, none of them having been measured. It would be difficult to find now a real star which would not fall upon or near one of these places. I do not think the Clark star can be fairly seen with an aperture very much less than that of the large telescope. Good admospheric conditions are necessary, and in making the measures given below, it could not be seen on many nights, although the seeing appeared to be good enough to make the attempt. As to the light-power of the 36 inch telescope, it is sufficient to refer to the new unequal pairs of the preceding list. These very minute companions, for example, θ Ursae, o Ursae, β Draconis, μ Draconis, 37 Comae, τ Coronae, ξ Argus, 47 Bootis, etc., are at least four or five times as bright as Clark's star, and correspondingly easier to see and measure. I have already stated in my measures with the Chicago $18\frac{1}{2}$ inch that the trapezium was repeatedly examined by me during a period covering serveral years, and that I was never able to see the least trace of any of the interior stars claimed to have been seen. Certainly the new star would be far beyond the grasp of that telescope, perfect as it is for every kind of difficult work. It is a significant fact that some of the largest and best instruments in Europe failed to show any of the supposed new stars soon after their announcement.

In this connection it may be of interest to cite the principal communications to astronomical periodicals relating to the alleged discovery of stars within the trapezium of Orion:

Sadler (Engl. Mech. XXXIV.448; Sid. Mess. VII.217).
Lassell (Mon. Not. XVII.68; XXII.164, 276).
Common (Ast. Reg. XVIII.116).
D' Abbadie (Mon. Not. XVII.245, 266).
Huggins (Mon. Not. XXVI.71; Ast. Reg. V.54).
Gill (Mon. Not. XXVII.315).
Buckingham (Mon. Not. XXXIII.228).
Tempel (A.N.1898).
Denning (A.N.1915; Obsy. III.356).
Porro (A.N.1091).
Salter (Ast. Reg. VIII.60, 96).
Denning (Ast. Reg. IX.37).
Key (Ast. Reg. IV.134).
Byles (Obsy. V.86).

The measures of the new star are as follows:

C and G (Clark's star).

1888.856	31°7	7″66	—, —	36
8.928	32.7	7.31	—, 16	36
9.049	37.9	7.81	—, 16	36
9.077	32.6	6.83	—, 16	36
1888.98	33.9	7.40	—, 16	

D and G.

1888.856	273.1	7.45	—, —	36
8.928	267.9	7.12	—, —	36
9.049	272.1	6.56	—, —	36
9.077	269.1	6.99	—, —	36
1888.98	270.5	7.03	—, —	

While the foregoing measures were being made, Mr. E. E. Barnard of this Observatory, detected another new star just oustide of and preceding the trapezium, and upon a careful examination, discovered that this excessively faint star was itself double. I was only able to see it on one night, and then made a fairly satisfactory measure, considering the extraordinarily difficult character of the object. It is infinitely more difficult than any double star I have ever attempted to see or measure; and certainly could not be seen by me with any smaller telescope. I could

not see it double on any other night on which measures were made. Only the most perfect atmospheric conditions are equal to so minute a pair, and even then it would be overlooked by the most experienced observers not possessing Mr. Barnard's rare acuteness of vision.

A and H (Barnard's star).

1888.928	178°.6	7".74	—, 16	36
9.077	178.2	8.14	—, 16	36
1889.00	178.4	7.94	—, 16	

C and H.

1888.928	275.1	9.17	—, —	36
9.049	276.1	8.41	—, —	36
9.077	275.7	8.29	—, —	36
1889.02	275.6	8.62	—, —	

H and H'.

1889.073	274.0	1.32	16, 16.5	36

Mr. Barnard has also discovered another excessively faint star within the trapezium on the line joining the bright stars B and C, and nearer the latter. I have not been able to see it, at least not with certainty, but I have no doubt of its existence, and hope to be able to measure it hereafter.

The accompanying diagram shows the relative positions of the stars of this interesting group as determined by the foregoing measures. A comparison of these measures with those made by Σ, Hall and others shows beyond question that the six principal stars are absolutely fixed with reference to each other so far as any change is concerned which could be detected by observations covering more than half a century.

For the purpose of making an accurate map, I had intended to connect each of the small stars near the trapezium with the bright stars by measuring the position angles from two points, but after a few observations it was given up as using time which could be better employed elsewhere. Of the stars observed in this way, four are north of the trapezium, and three south. These are all comparatively bright stars, and are probably found in the catalogues of stars in this region.

1888.895	52°.7	B and a
.895	17.7	D and a
.895	48.6	B and b
.895	22.1	D and b
.895	335.5	A and c
.895	305.8	B and c
.895	350.8	A and d
.895	326.4	B and d
.928	195.1	C and e
.928	176.1	A and e
.928	140.7	C and f
.928	190.2	D and f
.928	115.8	C and g
.928	143.5	D and g.

S. 503.

R.A. $5^h\,49^m\,10^s$ Decl. $+13°\,56'$.

A and B.

1889.096	9°.1	3".40	7, 8	36
.104	8.8	3.32	7, 8	36
.128	7.9	3.36	7, 8	36
1889.11	8.6	3.36	7, 8	

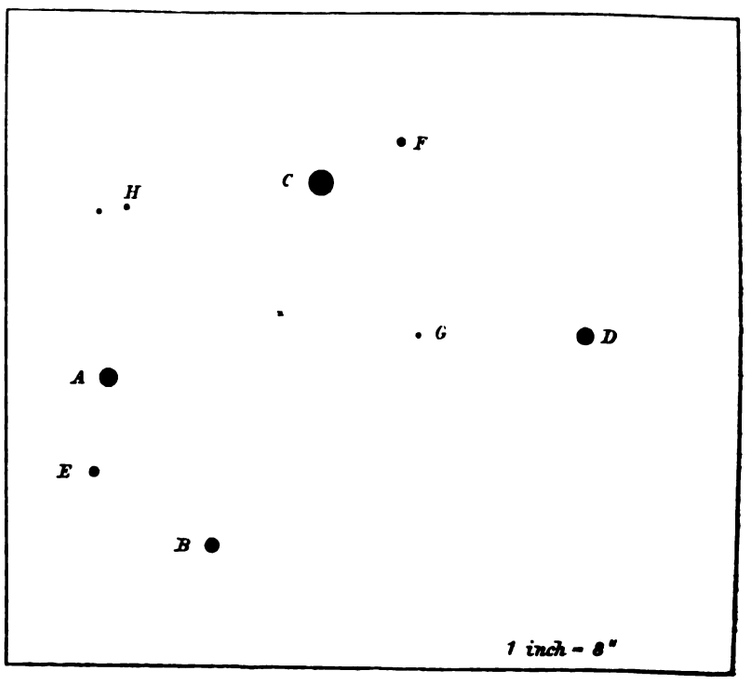
A and C.

1889.096	163.1	20.83	—, 10.5	36
.104	163.7	21.04	—, 11	36
.128	162.9	20.89	—, 11	36
1889.11	163.2	20.92	—, 10.8	

An interesting object from the proper motion of the larger star. The minimum distance must have been reached not far from 1883, and the nearer stars are now drifting apart. There are no measures between those of South in 1825 and Dembowski's in 1873. The former measured a distant star (201".76), which in 1883 I found was 234".09 from A. The small star, C, was first measured by me in 1878.

A and B.

1825.07	134°.1	39".94	S 2 n
1873.93	120.1	8.08	Δ 3 n
1881.18	99.3	3.58	β 3 n
1883.11	82.6	2.90	β 3 n
1889.11	8.6	3.36	β 3 n



A and C.

1878.00	157°.3	28".09	β 1 n
1883.10	158.8	24.61	β 4 n
1889.11	163.2	20.92	β 3 n.

β 1008. η Geminorum.

RA. $6^h 7^m 38^s$ Decl. +22° 32'.

1889.104	294°.6	1".34	3 , 10	36
.134	291.8	1.00	—, 11	36
.173	298.1	0.79	—, —	12
1889.14	294.8	1.04	—, 10.5	

There may be some change in the angle.

1882.05	301°.4	0".96	β 5 n.

A.G.C. 1. Sirius.

RA. $6^h 39^m 53^s$ Decl. −16° 33'.

1888.818	15.1	5.25	—, —	36
8.856	16.5	5.33	—, —	36
9.049	11.0	5.28	—, —	36
9.052	14.5	5.27	—, —	36
9.077	12.6	5.24	—, —	36
1888.97	13.9	5.27	—, —	

The companion to Sirius is a very easy object, under proper conditions, and is not likely to ever get beyond the reach of the large refractor.

I have carefully looked for other stars near Sirius, but without finding anything worth noting.

β 580.

RA. $7^h 38^m 1^s$ Decl. +28° 19'.

1889.142	130.9	1.14	9.5 , 12.5	36

This pair is the nearest of Herschel's companions to β Geminorum. The only other measures are:

1878.10	128°.0	1".40	β 2 n.

β 101. 9 Argus.

RA. $7^h 46^m 13^s$ Decl. −13° 35'.

1889.049	81.2	0.28	6 , 6.4	36
.077	75.6	0.34	6 , 6.5	36
.091	72.2	0.35	5.5 , 6	36
.093	76.6	0.39	5.5 , 6.3	36
1889.08	76.4	0.34	5.7 , 6.3	

This pair, which was discovered with the 6 inch in 1873, is certainly a binary in rapid motion. Some of the measures are:

1875.71	289°.4	0".46	Δ 3 n
1878.52	301.8	0.46	β 3 n.
1880.12	315.1	0.34	Hl 1 n
1883.11	336.2	0.3±	β 1 n
1888.26	356.1	0.29	Sp 5 n.

Σ 1196. ζ Cancri.

RA. $8^h 5^m 20^s$ Decl. +18° 1'.

1889.285, .296 | Examined under fairly good conditions with powers up to 1500 or more, and no other component, or near star, seen.

β 208.

RA. $8^h 33^m 54^s$ Decl. −22° 16'.

1889.131	44°.9	1".08	—, —	36
.173	50.1	1.05	7 , 8	12
1889.15	47.5	1.06	7 , 8	

There would seem to be no doubt of change in this pair from the following:

1874.20	30°.4	1".4±	β 1 n
1878.43	33 9	1.37	Cin$_3$ 5 n
1882.21	40.9	1.21	Sp 3 n
1889 15	47.5	1.06	β 2 n

Σ 1273. ε Hydrae.

RA. $8^h 40^m 25^s$ Decl. + 6° 52'.

A and B.

1888.818	151.0	0.27	4 , 6	36
9.151	157 9	0 25	4 , 6	36
1888.98	154.4	0.26	4 , 6	

AB and C.

1888.818	226.5	3.11	—, —	36
9.151	225.6	3.16	—, —	36
9.288	227.3	3.22	—, —	36
1889.08	226.5	3.16	—, —	

AB and D.

1889.151	193.5	19.71	—, 13	36
.288	194 1	19 66	—, —	36
1889.22	193.8	19.68	—, 13	

The duplicity of the principal star was detected by Schiaparelli in 1888, but an apparent elongation had been noted by $O\Sigma$ in 1860. It is a difficult pair, and will certainly prove to be a ternary system. The motion of C has been about 31° since 1830.

The distant companion was detected with the Washington 26 inch.

1888.28	142°.0	0".21	Sp 6 n	A and B
1878.60	192.0	20.05	β 2 n	AB and D.

Perrotin: DM. +8°2132.

RA. $8^h 44^m 49^s$ Decl. +8° 47'.

1889.107	351.0	0.97	8 , 8.7	36
.115	348.9	1.01	7.8 , 8.5	36
.131	350.4	0.88	8 , 8.7	36
1889.12	350.1	0.95	7.9 , 8.6	

Discovered by Perrotin, and stated to be in the vicinity of $O\Sigma$ 195, but no place given. I wished to identify the star, and find its position, and in doing that, made the measures given. The magnitude in DM. is 8.2. The only other measures are:

1884 20	349°.3	0".78	7.5 , 8.7	Per 2 n.

$\varkappa$ Cancri.

RA. $9^h 1^m$ Decl. $+11°10'$.

1889.131. This star was examined for the reason that Dawes and others noticed a gradual disappearance when occulted by the moon. I could see no sign of duplicity.

β 105. $\varkappa$ Leonis.

RA. $9^h 17^m 40^s$ Decl. $+26°42'$.

1889.107	204°.3	2".83	$4\frac{1}{2}$, 11	36
.134	201.6	2.71	—, 10.8	36
.151	205.8	2.83	—, 11	36
1889.13	203.9	2.79	—, 10.9	

Engelmann speaks of a 10" star in the direction of 65°. There is certainly no companion in this place, and no third star near in any direction. A difficult pair of small stars about 5' nf is given in the preceding list of new doubles.

There seems to be no change in $\varkappa$ Leonis.

1876.20	203°.8	3".05	Δ 5 n
1883.47	205.1	3.36	En 8 n.

Jacob 5. Lac. 3873.

RA. $9^h 25^m 26^s$ Decl. $-28°14'$.

1889.115	248.0	1.16	6, 7	36
.296	241.4	1.25	7, 7.3	36
.312	245.1	0.74	6, 7	36
1889.24	244.8	1.05	6.3, 7.1	

Discovered by Jacob during an occultation by the moon. Change is doubtful from the two preceding measures.

1858.1	244°.6	0".55	J 1 n
1878.53	235.5	0.58	Cin_3 2 n.

$O\Sigma$ 521. v Ursae Majoris.

RA. $9^h 42^m 30^s$ Decl. $+59°36'$.

1889.151	294.9	11.34	5, 13	36
.159	293.3	11.11	—, 13	36
.247	295.3	11.24	—, 11.5	36
1889.18	294.5	11.23	—, 12.5	

There is no relative motion, but the two stars must belong to the same system since they have the same considerable proper motion of 0".34 in the direction of 233°.7. The following are the only other measures I have found:

1855.58	295°.3	11".32	$O\Sigma$ 7 n.

A.C. 5. 8 Sextantis.

RA. $9^h 46^m 34^s$ Decl. $-7°32'$.

1889.091	121.5	0.44	5.5, 6.0	36
.131	128.0	0.45	$5\frac{1}{2}$, 6	36
.296	127.2	0.72	—, —	36
1889.17	125.6	0.54	$5\frac{1}{2}$, 6	

The last distance is too large, the images at the time being very unsteady. This pair is a binary, and in rapid motion. It was discovered by Mr. Clark in 1852 with a telescope of only $4\frac{3}{4}$ inch aperture. I found it apparently single with $18\frac{1}{2}$ inch in 1879–81.

1854.22	50°.5	0".5 ±	Da 1 n
1875.30	169.0	—	Δ 4 n
1878.22	117.4	0.2 ±	Cin 2 n
1878.26	161 ±	0.25 ±	β 2 n.

Σ 1424. γ Leonis.

RA. $10^h 13^m 20^s$ Decl. $+20°27'$.

1889.291	113°.8	3".64	—, —	36
.293	113.3	3.42	—, —	36
.302	116.7	3.48	—, —	36
1889.29	114.6	3.51	—, —	

These measures were made while looking for a suspected close star.

β 599. 65 Leonis.

RA. $11^h 1^m 50^s$ Decl. $+2°30'$.

1889.258	88.0	1.87	$5\frac{1}{2}$, 10.5	36
.274	87.6	1.74	5.8, 10.5	36
.285	89.9	1.72	5.5, 10.5	36
1889.27	88.5	1.78	5.6, 10.5	

A neighboring star, 55 Leonis, was found to be a new pair, and after observing that, this pair was measured. Change is doubtful.

1878.20	82°.4	1".78	β 4 n.

β 916. Crateris 31.

RA. $11^h 8^m 13^s$ Decl. $-14°47'$.

1889.134	359.0	1.03	7.5, 8	36
.312	1.8	0.90	7.5, 8.5	36
.323	359.8	0.70	7.5, 8.5	36
1889.25	0.2	0.88	7.5, 8.3	

No earlier measures except an angle of 357°.9 (1879.27) at Cin.

β 607.

RA. $12^h 35^m 2^s$ Decl. $-0°48'$.

1889 296	314.3	1.18	9, 10.2	36
.312	317.5	1.23	9, 10	36
.323	317.2	1.18	9, 10	36
1889.31	316.3	1.20	9, 10	

Near γ Virginis, 35^s p. There seems to be no material change.

1878.23	315°.9	1".15	β 6 n.

Σ 1670. γ Virginis.

RA. 12h35m37s Decl. −0° 47′.

A and B.

1889.296	153°.0	5″.58	—, —	36
.312	154.3	5.67	—, —	36
.323	153.0	5.90	—, —	36
1889.31	153.4	5.72	—, —	

A and C.

1889.293	159.0	53.43	—, 15	36
.296	158.2	52.81	—, 14.5	36
.312	161.0	53.12	—, 14	36
1889.30	159.4	53.12	—, 14.5	

The faint star measured as a light-test. It should not be confounded with a bright star about twice as far in the direction of 88°. This was called 15m by Herschel, but would be about 11m of the scale used here, which would make it twenty five times as bright as the other star.

β 609.

RA. 13h4m28s Decl. −4° 18′.

1889.302	351.6	0.87	6.8, 10	36
.312	342.9	0.94	7 , 9.5	36
.323	352.7	0.92	6.5, 10	36
1889.31	349.1	0.91	6.8, 9.8	

Poor seeing when the second measure was made. Very little if any change.

1878.32	356°.1	0″.89	β 1 n
1880.34	356.1	0.82	Cin$_6$ 2 n.

β 935. 86 Virginis.

RA. 13h39m33s Decl. −11° 49′.

A and B.

1889.293	298.0	1.54	6 , 10	36
.296	299.8	1.87	6 , 10	36
.302	300.9	1.58	5.5, 10	36
1889.30	299.6	1.66	5.8, 10	

C and D.

1889.293	276.1	2.08	10 , 11	36
.296	276.4	2.37	10.5, 11	36
.302	275.3	2.28	11 , 11.5	36
1889.30	275.9	2.24	10.5, 11.2	

A and C (= Σ 1780 rej.)

1889.293	164.2	27.24	—, —.	36
.296	165.5	27.09	—, —	36
.302	165.2	27.19	—, —	36
1889.30	164.6	27.17	—, —	

A beautiful quadruple star. It was observed by H_2 and Σ as a double, but they failed to notice that each of the stars was double. Thus far there seems to be little evidence of change.

1879.37	298°.4	1″.61	β 5 n	AB
1879.40	274.2	1.72	β 3 n	CD
1879.33	164.7	26.94	β 2 n	AC.

The 36 inch shows two new nebula in the field with this quadruple. They are small and diffused, and not very faint. One is 4½s p, and 136″.8 s; and the other 19½s p, and 101″.6 s.

β 348. 2 Serpentis.

RA. 14h55m40s Decl. +0° 20′.

1889.302	121°.3	0″.80	6 , 6.7	36
.312	116.8	0.72	Poor seeing	36
1889.31	119.0	0.76	6 , 6.7	

β 943.

RA. 15h12m16s Decl. +1° 23′.

1889.296	92.1	2.51	6 , 11.8	36
.302	92.8	2.70	6 , 12	36
.312	93.1	2.67	6.5, 13	36
1889.30	92.7	2.63	6.2, 12.3	

Apparently without change.

1879.70 92°.5 2″.30 β 4 n.

β 32. 6 Serpentis.

RA. 15h14m54s Decl. +1° 9′.

1889.296	19.6	2.51	5.5, 10	36
.302	15.0	2.45	6 , 10	36
.312	19.1	2.36	6 , 10	36
1889.30	17.9	2.44	5.8, 10	

There may be a little increase in the angle.

1875.43	13°.2	2″.28	Δ 4 n
1885.49	14.1	2.27	Tarrant 3 n.

β 818. 32 Herculis.

RA. 16h28m50s Decl. +30° 45′.

1889.244	34.4	3.55	6, 13.5	36
.293	31.0	3.37	6, 13	36
.312	33.2	4.01	6, 14	36
1889.28	32.9	3.64	6, 13.5	

The companion, with the 15½ inch refractor of the Washburn Observatory, with which it was discovered, was of the last degree of difficulty; and it is not prominent even with this telescope. The only other measures are:

1881.48 33°.5 3″.29 β 3 n.

Küstner 1.

RA. 16h48m27s Decl. +77° 43′.

1889.173	187.9	2.70	7.3, 10.5	12
.227	188.9	2.70	7 , 10	36
.247	191.1	2.76	6.8, 10.5	36
1889.21	189.3	2.72	7 , 10.3	

Discovered by Küstner with the Berlin Meridian Circle (A. N. 2756). There are no published measures of this pair.

α Herculis.

RA. $17^h 9^m 10^s$ Decl. $+14° 32'$.

A and C.

1888.671	333°9	23".97	—, 15	36
9.312	337.7	23.12	—, 15	36
1888.99	335.8	23.54	—, 15	

A faint star noted by Mr. Alvan G. Clark. It has not been measured before.

β 633. γ Draconis.

RA. $17^h 53^m 49^s$ Decl. $+51° 30'$.

1889.227	151.5	21.11	—, 12	36
.244	151.0	21.17	—, 13	36
.288	151.3	21.02	—, —	36
1889.25	151.3	21.10	—, 12.5	

The only prior measures are:

1879.09 151°9 20".91 β 4 n.

Σ 2272. 70 Ophiuchi.

RA. $17^h 59^m 23^s$ Decl. $+2° 33'$.

A and B.

1889.296	349.0	2.16	—, —	36
.312	348.5	2.16	—, —	36
1889.30	348.7	2.16	—, —	

A and C.

1889.296	203.6	59.40	—, 13	36
.312	203.0	59.51	—, 12.5	36
1889.30	203.3	59.45	—, 12.7	

A and D.

1889.296	43.3	95.29	—, 12.5	36
.312	43.2	95.06	—, 12	36
1889.30	43.2	95.17	—, 12.2	

Secchi measured these two faint stars in 1856. When observed by Hall in 1878, it appeared that the nearest of the two had a large proper motion nearly at right angles to that of 70 Ophiuchi. Comparing the above measures with Hall's, it is seen at once that the change in the two faint stars is the same, and corresponds exactly to the recognized proper motion of 70 Ophiuchi, and that neither of them has any sensible motion of its own. Laying off the measures to scale, and taking the change in place of the faint stars as determined by the two sets of measures, we find the proper motion of the binary system to be, roughly, 1".2 in the direction of 173°. The measures of Secchi of the sp star are evidently erroneous, or belong to some other star. The distance of this star in 1856 should have been 97" in the direction of 191°. His angle of the nf star was exactly right. The distance at that time, by the diagram, should have been about 75". The distance of this star is of course increasing. Roughly speaking, the minimum distance of the sp star from 70 Ophiuchi of 30" will be reached about the year 1932. The measures to this time are as follows:

1856.63	215°1	87".57	Se 1 n
1878.84	197.8	71.38	Hl 3 n
1889.30	203.3	59.45	β 2 n.

For the other star we have:

1856.62	67°2	—	Se 1 n
1878.84	49.6	87".21	Hl 3 n
1889.30	43.2	95.17	β 2 n.

The motion of the close pair has been 82°6 since the measures of Hl in 1879. I could not see any third component, and both stars appeared to be round with all powers.

Küstner 2.

RA. $19^h 35^m 38^s$ Decl. $+71° 20'$.

1889.173	271°9	1".35	8, 9.5	12
.312	272.9	1.45	6.5, 8.5	36
.315	268.5	1.52	7, 9.5	12
1889.27	271.1	1.44	7.2, 9.2	

Discovered by Küstner with the Berlin Meridian Circle (A. N. 2756). So far as I am aware, it has not been measured before.

Ho. 137.

RA. $20^h 35^m 37^s$ Decl. $+29° 23'$.

1888.644	272.5	1.01	7, 10	12
.859	274.5	0.76	7, 10	12
1888.75	273.5	0.88	7, 10	

Discovered by Hough (A.N. 2779). He found:

1885.83 278°9 1".23 Ho 2 n.

Ho. 152.

RA. $21^h 7^m 20^s$ Decl. $+27° 51'$.

1888.644	333.7	0.69	8.5, 9.0	12
.859	324.2	0.71	8.7, 9.5	12
1888.75	328.9	0.70	8.6, 9.2	

Discovered by Hough who gives:

1882.66 320°2 0".49 Ho 3 n.

A. G. Clark. τ Cygni.

RA. $21^h 10^m 0^s$ Decl. $+37° 32'$.

A and B.

1888.733. Single with all powers up to 3300. Good definition.

AB and C.

1889.312	247.3	19.44	—, 13.5	36
.323	246.2	19.23	—, 13	36
1889.32	246.7	19.33	—, 13.2	

The only other measure of C is by Hall, 260°; 15".68 (1876.90) 1 n. The proper motion of A according to Auwers is 0".48 in 17°4, which appears to substantially account for the change in C. The seeing was not good enough when the measures were made to look for the close star. Gore finds a period of 53.87 years.

$O\Sigma$ 482. B.A.C. 7990.

R.A. $22^h 47^m 55^s$ Decl. $+82° 31'$.

1889.293	32°8	3″64	5 , 11	36
.312	38.3	3.23	— , 10.5	36
.323	36.5	3.34	5.5, 10.5	36
1889.31	35.9	3.40	5.2, 10.7	

Very little change. The following are all the previous measures :

1850.59	30°2	3″46	$O\Sigma$ 6 n
1866.61	33.0	3.71	Δ 3 n.

Ho. 200.

R.A. $23^h 24^m 19^s$ Decl. $+85° 45'$.

1889.293	140°5	2″35	7 , 10	36
.312	143.1	2.44	6.5, 11	36
.323	144.1	2.36	6.3, 10.8	36
1889.31	142.6	2.38	6.6, 10.6	

The only other measures are :

1885.83	137°7	1″73	Ho 2 n.

Mc Hamilton 1889 May 1.

(6)

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Double Star Observations

made in 1890 with the 36 inch Equatorial of the Lick Observatory.

By *S. W. Burnham.*

The double star observations which follow, represent the principal portion of my work in this direction during the year 1890. Substantially all the work was done between April 1 and December 1. On two nights of the week the large telescope has been used by me for micrometrical work, when the weather on these nights has been favorable. A few measures have been made at other times with the 12 inch, but nearly all of the measures given here were made with the great telescope. The character of the objects selected for re-measurement was such that it was very desirable to attain all the accuracy possible by employing the more powerful instrument, and many of the stars could not be seen at all with the other. Most of the new stars found from time to time, including some of those which were discovered with the 12 inch, are much too close or unequal for satisfactory measurement with that instrument. The large telescope leaves nothing to be desired in this or any other class of micrometrical work. The definition of the object-glass, like that of most, if not all, of the telescopes made by Clark & Sons, is practically perfect with proper atmospheric conditions. The driving clock by Warner & Swasey has worked perfectly from first to last, without a single failure at any time, and is probably as fine a piece of mechanism of its kind as can be found anywhere.

The micrometer by Fauth & Co. is most complete and satisfactory, and with the method employed for illuminating the wires, any object, however faint and difficult, can be measured. I am satisfied that there is no plan in use for illuminating the lines and controlling their brightness so unobjectionable in every respect as the one applied to this micrometer. A description and cut of the 12 inch micrometer, of which the large micrometer is a copy in all essential details, will be found in the introduction to my observations with the Chicago refractor in 1879–80 (Memoirs of the R.A.S. XLVII. 171). The light is furnished by a small oil lamp as in the original device, and after some experiments with electric lighting, I am convinced that the oil lamp is far less trouble to use, and superior to the other method. There is nothing to get out of order, and the sole attention required is to occasionally fill the lamp with sperm oil to which has been added about twenty per cent of kerosene.

The observing chair, with its simple sliding seat, designed by Professor Hough (Monthly Notices, March, 1881) has proved as serviceable here as elsewhere. It is certainly the best arrangement ever invented for use with either a large or a small telescope. It would be almost impossible to get along without it in doing this class of work with the large equatorial. When the driving-clock is attached, the movement of the eyepiece, which is nearly thirty feet from the centre of motion, is so rapid, that it is necessary, every two or three minutes in some positions of the instrument, to raise or lower the seat in order to have the observer in a comfortable and convenient position in using the micrometer, and any but a simple device of this kind would be impracticable.

The 12 inch refractor is provided with similar accessories which work in an equally satisfactory manner. It only remains to be said in this connection that any errors or shortcomings which may appear in the observations following, must be charged entirely to the observer, and not to the instruments with which the work was done.

The methods of observation are the same as heretofore. With few exceptions each star has been measured on at least three nights. The angles are usually from four or five settings of the wires, with three readings for distance on each side of the fixed wire. There appears to be nothing gained by taking any more readings on a single night.

In the selection of stars for re-observation, I have endeavored to take such pairs as could not, or would not, be observed elsewhere, leaving the old binaries and other easy pairs, to be looked after by other observers. Nearly all of the most interesting physical systems, and especially those in rapid motion, are difficult objects to measure, and many of them beyond the reach of any but the most powerful telescopes. These are largely of recent discovery, and of which few measures have been made. Stars of this class have been kept on the working-list, and as far as possible will be measured every year. Another class of stars, principally from my own catalogues, with every indication so far as the distance is concerned, of physical relation, have been measured previous to this time only once; and these have received some attention, with the result of finding some in apparently rapid motion. I have also looked up a good many stars of doubtful duplicity, and the results, negative and otherwise, will be found in the measures. As a rule observations of this kind, when the stars were not seen double, are only noted when the

conditions were sufficiently favorable to warrant the positive statements made regarding the probable duplicity. Negative results with the large telescope, as with any other, are of little value except when obtained on first class nights; and, therefore, when from the lack of good definition, or from other unfavorable conditions, it was doubtful whether a slight elongation could be seen, I have made no note of the observation. The measures and discoveries will show how far it is probable that any pair seen elsewhere would be missed here.

The catalogue of new stars contains 70 pairs, of which number 39 have distances less than 1", with an average distance of 0".45. Of the latter number 25 are less than 0".5, the average distance being 0".33. The new stars cover a wide range of magnitudes, some of the closest of them being near the limits of the Durchmusterung. The following naked eye stars are included in the list of new stars:

B.A.C. 230	5 Camelop.
Ceti 199	ν Geminorum
95 Piscium	36 Geminorum
χ Persei	65 Geminorum
48 Cephei (H)	τ Herculis
34 Persei	24 Aquarii
B.A.C. 1142	ψ^1 Aquarii
Tauri 248	

The following pairs previously known have been found to be more closely double:

H 1981	Σ 2476
S 409	$O\Sigma$ 425
Σ 809	Σ 12, App. II
$O\Sigma$ (App.) 77	

These are all sufficiently difficult to account for their having been overlooked heretofore.

While no rule, unless it is a very general one, can be laid down for the limits of distance in noting new pairs, it is certainly true that so far as stars are concerned which will probably prove to be binary, it is hardly worth while saving any where the distances of equal stars are not decidedly under 2". Nearly all the pairs in rapid motion are less than 1". A new class of doubles, unknown in the older catalogues, consisting of bright naked-eye stars, with very small companions at distances varying from 0".8 to 2", has been added within a few years. Down to the commencement of work with the 36 inch telescope, nearly all the examples of this class were discovered with the Chicago 18 1/2 inch. A few were found by the Clarks, and some of these have already been shown to be of the most interesting character, for instance τ Cygni, 99 Herculis, 95 Ceti, etc. It is not improbable some very short periods will be found in this class of stars. Some interesting systems may be expected when the stars of this class discovered here are re-measured in the future.

If my purpose had been to make an imposing catalogue of discoveries by finding as many new pairs as possible without reference to their character, the number in my lists down to this time could easily have been made many times larger, without exceeding the Struve limits of magnitudes and distance; but at this time there would seem to be no good reason for encumbering a double star catalogue with that kind of material. We know now that they can have no interest as double stars in the proper sense of the term. With the large telescope pairs of 5" or 6" distance in the lower magnitudes of the Durchmusterung can be found by the score on any night, even when the seeing is too poor for ordinary micrometrical work; and with the 12 inch it would be easy to make a large list in a comparatively short time. I have not allowed myself to find new pairs of the kind recorded here, any faster than they could be thoroughly measured. It may be many years before some of these are re-observed, and it is desirable to have a careful set of measures at this time with which to compare future observations.

At the end of the double star observations will be found a few new nebulae which have been incidentally found in the course of the other work.

All places, as in my previous catalogues, are for 1880.

Seventeenth Catalogue of new double stars.

β 1155. DM. +3°4933.
RA. $0^h0^m40^s$ Decl. +3° 47'.

1890.802	91°.1	0".45	8.6, 9	36
.824	86.7	0.46	9, 9.5	36
.840	93.4	0.41	8.6, 9.5	36
1890.82	90.4	0.44	8.7, 9.3	

β 1156. DM. +63°48.
RA. $0^h19^m58^s$ Decl. +63° 46'.

1890.725	31.7	0.52	9.5, 9.6	36
.747	33.9	0.57	9.0, 9.1	36
.760	30.2	0.48	9.0, 9.2	36
1890.74	31.9	0.52	9.2, 9.3	

This pair, and the one next following, were found during an examination of the place given by d'Arrest for Tycho Brahe's star. That is a little sp this star.

β 1157. DM. +63°52.
RA. $0^h22^m30^s$ Decl. +63° 35'.

1890.725	89°.7	1".65	8.5, 11.5	36
.747	90.7	1.68	8.3, 11.5	36
.760	90.1	1.64	8.5, 11.0	36
1890.74	90.2	1.66	8.4, 11.3	

This is 8.0 mag. in DM. Discovered with the 12 inch. Much easier than the preceding pair, which is in the same vicinity.

β 1158. Lal. 718.
RA. $0^h24^m55^s$ Decl. −10° 45'.
B and C.

1890.898	138.6	0.20	8.8, 8.8	36
.900	135.4	0.29	8.5, 8.5	36
.939	140.4	0.28	8.5, 8.5	36
1890.91	138.1	0.26	8.6, 8.6	

A and BC. (H 1981).

1890.898	86°6	79".22	5.5, —	36
.933	86.4	79.31	7.3, —	36
.939	86.7	79.41	7.8, —	36
1890.91	86.6	79.31	— —	

The wide pair constitutes the double star, H 1981. The RA. in Herschel is 1m too large. He gave the angle 84°8, and the estimated distance 60", and the magnitudes 8 and 9. The magnitude of the companion in SD. is 8".6. The different magnitudes given to the principal star cover a wide range. Lalande and Schjellerup 8; Gould 7.5; Schönfeld 7.2; Heis 6.7; and my own estimate in the first observation which made it still brighter. It is not known as a variable star, but it seems hardly possible that the magnitudes could differ so much if there is really no change in brightness. It would be well for variable star observers to give it a little attention.

The new pair is a difficult object, and likely to prove an interesting one.

β 1159. DM. +39°148.

RA. 0h 32m 28s Decl. +40° 1'.

1890.681	37.2	0.25	10, 10.2	36
.687	43.4	0.29	9.3, 9.5	36
.689	44.6	0.16	9.8, 10	36
1890.68	41.7	0.23	9.7, 9.9	

This unusually minute and difficult pair is involved in the extreme preceding end of the Great Nebula in Andromeda. The magnitude is 8.9 in DM. It is difficult enough to test the powers of even the 36 inch; and probably no other telescope will show it well.

β 1160. B.A.C. 230.

RA. 0h 43m 24s Decl. −14° 13'.

1890.675	114.2	1.39	6, 13	36
.689	112.4	1.18	5.5, 11.5	36
.709	112.7	1.01	6, 11.5	36
1890.69	113.1	1.19	5.8, 12.0	

The magnitude in Gould is 5.9.

β 1161. Lal. 1766.

RA. 0h 55m 50s Decl. +51° 9'.

1890.689	324.2	0.53	6.8, 7.5	36
.709	323.0	0.45	7, 7.5	36
.725	325.5	0.45	7, 8	36
1890.71	324.2	0.48	6.9, 7.7	

β 1162. DM. +35°215.

RA. 1h 3m 52s Decl. +35° 18'.

1890.675	142.2	0.31	8.8, 9	36
.681	138.2	0.36	9.3, 9.4	36
.689	140.5	0.36	9.5, 9.7	36
1890.68	140.3	0.34	9.2, 9.4	

This close pair is about 25' nf β Andromedae.

β 1163. Ceti 199.

RA. 1h 18m 18s Decl. −7° 32'.

1890.675	195°1	0".17	6, 6	36
.681	194.5	0.15	6, 6.5	36
.689	187.2	0.24	6, 6	36
1890.68	192.3	0.19	6, 6.2	

β 1164. 95 Piscium.

RA. 1h 21m 26s Decl. +4° 44'.

1890.802	167.0	0.42	7, 7.5	36
.824	168.7	0.39	6.5, 6.8	36
.832	169.4	0.35	6.5, 7	36
1890.82	168.4	0.39	6.7, 7.0	

In the B.A.C. this is 95 Piscium, 7m. The magnitude in the DM. is 8.0, and in Boss 7.3.

β 1165. W_2 1h510.

RA. 1h 24m 51s Decl. +40° 27'.

1890.807	61.4	2.02	8.3, 12	12
.829	68.1	1.69	8, 12	12
.835	57.0	1.90	8.7, 12	12
.854	63.2	1.66	8.8, 12.5	12
1890.83	62.4	1.82	8.4, 12.1	

Found and measured with the 12 inch. It is a difficult pair with that instrument.

β 1166. Lal. 2980.

RA. 1h 31m 45s Decl. +37° 53'.

1890.807	346.7	2.64	8.3, 11	12
.829	343.7	2.43	8.5, 11.5	12
.835	347.1	2.81	8.3, 12	12
1890.82	345.8	2.63	8.4, 11.5	

Discovered with the 12 inch.

β 1167. W_2 1h716.

RA. 1h 33m 16s Decl. +38° 7'.

1890.807	56.5	1.16	9.5, 11	12
.829	56.6	1.29	9.2, 10.5	12
.835	55.4	1.30	9.3, 10.5	12
1890.82	56.2	1.25	9.3, 10.7	

Discovered and measured with the 12 inch. The magnitude in DM. is 8.8.

β 1168. Schj. 534.

RA. 1h 43m 48s Decl. −10° 58'.

1890.675	202.5	0.32	8, 8.2	36
.681	204.0	0.31	8, 8.7	36
.689	202.5	0.36	8.3, 8.5	36
.785	203.2	0.30	7.5, 8	36
1890.71	203.0	0.32	8.0, 8.3	

This close pair is 1m44s preceding, and 2'.4 south of ζ Ceti.

β 1169. DM. +51°420.

RA. 1h44m17s Decl. +51° 46′.

1890.835	207°3	2″08	8.5, 12	12
.854	202.8	2.33	8.5, 12.5	12
.856	209.0	2.18	8.5, 12.5	12
1890.85	206.4	2.20	8.5, 12.3	

Discovered with the 12 inch.

β 1170. χ Persei.

RA. 2h9m39s Decl. +56° 58′.

B and C.

1890.687	311.6	0.35	11, 11.5	36
.760	313.4	0.25	12, 12.1	36
.785	314.8	0.20	11.5, 11.5	36
1890.74	313.3	0.27	11.5, 11.7	

A and BC.

1890.687	353.2	70.35	6.3, —	36
.689	353.2	70.48	6.2, 11	36
.785	353.6	70.33	—, —	36
1890.74	353.3	70.39	—, —	

The companion to the principal star in the great cluster in Perseus is an exceedingly minute and close pair, and of the last degree of difficulty. I do not think an other telescope can possibly show this pair. The distance in the first measure was noted as »too large«. It resembles the one found in the nebula of Andromeda, but is very much fainter, and correspondingly more difficult.

The only other measures of this distant companion were made with the Chicago refractor:

1879.55 352°6 70″47 β 2 n.

A still more distant companion makes S 409.

β 1171. DM. +56°556.

RA. 2h12m45s Decl. +56° 18′.

1890.687	23.9	1.11	8.5, 13.5	36
.689	21.2	1.13	8.7, 13.5	36
.760	19.2	0.80	8.7, 12.5	36
1890.71	21.4	1.01	8.6, 13.2	

Another pair in the great Perseus Cluster; the south star of two about 1′ apart. It is 9m2 in DM.

β 1172. DM. +56°635.

RA. 2h21m26s Decl. +56° 42′.

1890.687	238.0	1.65	8.7, 10	36
.689	237.8	1.65	8.6, 11.5	36
.760	239.2	1.63	8.0, 10.5	36
1890.71	238.3	1.64	8.4, 10.9	

This is also in the borders of the Perseus Cluster.

β 1173. Arietis 133.

RA. 2h50m4s Decl. +23° 32′.

A fine triple star, but the close pair is very difficult. The principal star (= Lal. 5468 = W_2 2h1202) is 6m8 in the DM.

A and B.

1890.879	326°0	0″11	7.7, 7.8	36
.882	324.8	0.14	7.5, 7.6	36
.893	325.5	0.13	7.8, 8	36
1890.88	325.4	0.13	7.7, 7.8	

AB and C.

1890.879	283.7	4.54	7.5, 12.5	36
.882	285.1	4.64	—, 13.5	36
.893	282.0	4.72	—, 13	36
1890.88	283.6	4.63	—, 13	

β 1174. Lal. 5683.

RA. 2h57m46s Decl. —11° 26′.

1890.802	304.9	1.25	7.8, 11	36
.832	305.7	1.16	7.5, 12	36
.840	307.1	1.24	7.7, 11	36
1890.82	305.9	1.22	7.7, 11.3	

Discovered with the 12 inch.

β 1175. Lal. 5636.

RA. 2h57m47s Decl. +43° 14′.

1890.673	282.8	0.25	7, 8.5	36
.675	280.0	0.22	7, 8.5	36
.681	280.0	0.30	8, 9	36
1890.68	280.9	0.26	7.3, 8.7	

β 1176. 48 Cephei (H).

RA. 3h5m9s Decl. +77° 17′.

A and B.

1890.633	281.1	1.21	—, 11	36
.652	274.9	1.06	—, 13	36
.673	276.7	1.26	—, 13.5	36
1890.65	277.6	1.18	—, 12.5	

A and C.

1890.610	228.0	10.81	5.5, 13.5	36
.633	228.0	11.11	5.5, 13	36
.652	227.8	10.94	6, 13.5	36
1890.63	227.9	10.95	5.7, 13.3	

A fine triple, but not a very easy one. The outside companion was measured twice before the close star was detected. This is B. A. C. 979.

β 1177. Lamont 464.
RA. 3h 12m 45s Decl. −1° 28′.

1890.802	24°0	0″45	9.3, 9.3	36
.824	24.6	0.38	9 , 9	36
.832	25.4	0.32	9 , 9	36
1890.82	24.7	0.38	9.1, 9.1	

Found during one of the many attempts to see that most singular double star, 95 Ceti. This new pair is 31°7 f, and 5′ 42″ s of that star. The magnitude in SD. is 9.3.

β 1178. Tauri 7 = Lal. 6267.
RA. 3h 17m 20s Decl. +4° 27′.

1890.882	347.5	0.90	6.5, 12	36
.890	346.2	1.11	6.7, 12	36
.898	349.7	0.97	6.5, 13	36
1890.89	347.8	0.99	6.6, 12.3	

The magnitude in the DM. is 7.7, and in Boss 7.3; while Gould gives 6.6. It is certainly as bright as that now.

β 1179. 34 Persei.
RA. 3h 20m 47s Decl. +49° 6′.

1890.610	162.0	0.68	6.5, 11	36
.633	161.6	0.76	6 , 11	36
.652	164.1	0.68	5.5, 12.5	36
.660	166.0	0.60	5.5, 12	36
1890.64	163.4	0.68	5.9, 11.6	

A more difficult pair than the distance and relative magnitudes would indicate.

β 1180. Lal. 6417.
RA. 3h 22m 23s Decl. −4° 59′.

A and B.

1890.802	24.7	0.42	8.5, 9	36
.824	24.6	0.46	8.5, 9	36
.832	25.2	0.45	8 , 10	36
1890.82	24.8	0.44	8.3, 9.3	

A and C.

1890.802	117.6	7.09	— , 12	36
.824	118.3	7.16	— , 11.5	36
.832	117.8	7.15	— , 11	36
1890.82	117.9	7.13	— , 11.5	

β 1181. Lal. 6685.
RA. 3h 32m 53s Decl. +45° 31′.

1890.652	270.5	0.36	8 , 8.1	36
.660	266.9	0.31	8.3, 8.5	36
.673	274.2	0.38	8 , 8.3	36
1890.66	270.5	0.35	8.1, 8.3	

Near OΣ 59.

β 1182. Lal. 6759.
RA. 3h 35m 28s Decl. +48° 9′.

A and B.

1890.610	260°3	4″56	6 , 13.5	36
.630	262.1	4.24	6.5, 14.5	36
.633	—	4.31	6.8, 14.5	36
1890.62	261.2	4.37	6.4, 14.2	

A and C.

1890.610	242.9	19.56	— , 13	36
.630	242.4	19.20	— , 13.5	36
.633	—	19.04	— , 14	36
1890.62	242.6	19.27	— , 13.5	

The micrometer was disturbed during the evening of the last measure, and some of the position-angles were lost.

β 1183. B.A.C. 1142.
RA. 3h 37m 35s Decl. +45° 18′.

1890.610	139.3	6.44	6 , 14.5	36
.660	139.8	6.19	6.5, 14.5	36
.673	140.5	6.82	6.5, 15	36
1890.65	139.9	6.48	6.3, 14.7	

β 1184. DM. +21°526.
RA. 3h 41m 14s Decl. +22° 0′.

1890.785	272.9	0.66	8.2, 8.3	36
.851	271.8	0.61	8.0, 8.5	36
.867	272.0	0.59	8.0, 8.2	36
1890.83	272.3	0.62	8.1, 8.3	

β 1185. W2 4h376.
RA. 4h 18m 52s Decl. +18° 35′.

1890.660	33.6	0.15	7.6, 8.5	36
.681	18.3	0.16	8.0, 8.5	36
.689	25.1	0.18	8.0, 8.5	36
.775	25.4	0.14	7.5, 8.0	36
1890.70	25.6	0.16	7.8, 8.4	

The magnitude in DM. is 7.5.

β 1186. Tauri 248 = Lal. 8372.
RA. 4h 20m 51s Decl. +10° 56′.

1890.906	185.0	0.63	6.8, 9.5	36
.911	180.4	0.61	6.7, 9	36
.939	181.0	0.53	6.8, 10.5	36
1890.92	182.1	0.59	6.8, 9.7	

In Argelander and Heis 6m, and as bright as that in most of the catalogues.

β 1187. 5 Camelopardi.
RA. 4h 45m 14s Decl. +55° 4′.

1890.775	245.4	12.86	5.5, 12	36
.777	245.3	12.90	5.5, 13.5	36
.785	244.9	12.90	5.5, 13	36
1890.78	245.2	12.89	5.5, 12.8	

β 1188.
RA. $5^h 44^m 33^s$ Decl. −1° 28′.

A and B.

1890.832	103°.0	1″.01	7.8, 10.5	36
.840	108.4	1.29	8 , 10.5	36
.851	106.7	1.38	7.8, 10	36
1890.84	106.0	1.23	7.9, 10.3	

A and C. (= Σ 809).

1890.840	98.5	25.38	— , 9	36
.851	98.1	25.22	— , 8.5	36
.862	98.4	25.37	7.8, 8.5	36
1890.85	98.3	25.32	— , 8.7	

The new pair is the principal star of Σ 809. The Struve star appears to be fixed:

1831.16	101°.2	25″.70	Σ 3 n.
1868.56	99.6	25.25	De 4 n.
1879.02	98.3	25.22	β 2 n.

β 1189. Schj. 1985.
RA. $5^h 51^m 8^s$ Decl. +0° 23′.

A and B.

1890.879	267.4	0.23	8 , 9	36
.890	271.2	0.13	8.3, 9	36
.939	269.8	0.23	8 , 9.2	36
1890.90	269.5	0.20	8.1, 9.1	

AB and C.

1890.840	194.5	58.02	— , 8	36
.862	194.5	58.21	8 , 8	36
1890.85	194.5	58.11	— , 8	

The magnitudes of A and B in the DM. are 9.0 and 9.2. DM. +0°1230, 1229.

β 1190. W_1 5^h1269.
RA. $5^h 51^m 17^s$ Decl. +0° 1′.

A and B.

1890.840	341.2	1.25	7 , 10.5	36
.851	339.5	1.37	7.8, 11	36
.862	339.7	1.61	7.5, 11	36
1890.85	340.1	1.41	7.4, 10.8	

A and C.

1890.840	95.2	6.72	— , 13	36
.851	95.2	6.62	— , 12	36
.862	96.0	6.62	— , 12.5	36
1890.85	95.5	6.65	— , 12.5	

A triple star near the last. The distant companion is noted in the Harvard Zones, where it is called 17 magnitude, and distance estimated 8″.

β 1191. Lal. 12262.
RA. $6^h 19^m 9^s$ Decl. +18° 50′.

1890.890	163°.0	1″.45	6.8, 14	36
.939	162.3	1.42	7.0, 14.5	36
.955	159.1	1.13	7.3, 13	36
1890.93	161.5	1.33	7.0, 13.8	

A difficult pair most of the time.

β 1192. ν Geminorum.
RA. $6^h 21^m 50^s$ Decl. +20° 17′.

B and C.

1890.879	341.0	0.14	9.0, 9.2	36
.882	349.1	0.18	8.5, 8.6	36
.890	348.4	0.12	8.5, 8.7	36
1890.88	346.2	0.15	8.7, 8.8	

A and BC. (= OΣ App. 77).

1890.854	329.3	112.48	— , —	36
.862	329.2	112.80	— , —	36
.879	329.5	112.80	— , —	36
1890.86	329.3	112.69	— , —	

This is one of the bright stars with distant companions given in OΣ's Catalogue of wide pairs. This companion star is an exceedingly close double, and one not likely to be found with any much smaller telescope. One would expect rapid motion in such a pair. The only other measures of this from the large star are the following:

1876.02 329°.1 112″.54 De 3 n.

Evidently there has been no change. If the principal star has any proper motion it is extremely small. The large telescope shows a number of faint stars nearer than this companion. I have measured most of them. The nearest one is quite difficult to measure, but the others are easily seen.

A and a.

1890.862	359.3	22.30	— , 15	36
.879	356.9	22.78	— , 15	36
.890	357.9	22.86	— , 15	36
1890.88	358.0	22.65	— , 15	

A and b.

1890.862	13.6	53.99	— , 13	36
.879	13.0	53.80	— , 14.5	36
1890.87	13.3	53.90	— , 13.8	

A and c.

1890.862	254.3	57.06	— , 12	36
.890	255.0	56.47	— , 13	36
1890.87	254.6	56.76	— , 12.5	

A and d.

1890.862	11.5	92.22	— , 12	36
.879	11.7	92.04	— , 14	36
1890.87	11.6	92.13	— , 13	

β 1193. 36 Geminorum.

RA. $6^h42^m52^s$ Decl. +21° 56′.

1890.879	355°.8	10".62	6 , 15	36
.890	355.2	11.05	5 , 14.5	36
.939	354.1	10.76	6 , 14	36
1890.90	355.0	10.81	5.7, 14.5	

A very small companion.

β 1194. 65 Geminorum.

RA. $7^h22^m21^s$ Decl. +28° 10′.

1890.879	289.1	13.89	5 , 14	36
.882	289.7	14.06	5.5, 14.5	36
.890	289.8	13.77	6 , 13.5	36
1890.88	289.5	13.91	5.5, 14	

A faint attendant similar to the last.

β 1195. Lal. 15331.

RA. $7^h45^m35^s$ Decl. −9° 6′.

1890.903	81.7	0.46	7.5, 8	36
1.052	80.8	0.43	7.0, 7.2	36
1.055	81.8	0.49	7.5, 7.7	36
1891.00	81.4	0.46	7.3, 7.6	

β 1196. DM. +60°1127.

RA. $8^h8^m55^s$ Decl. +59° 57′.

1890.882	63.0	0.44	8.5, 10.5	36
1.052	61.0	0.46	8.5, 10.5	36
1890.97	62.0	0.45	8.5, 10.5	

This is 63^s f a 6^m star, and 40″n. The magnitude in DM. is 9.2.

β 1197. Lac. 5791.

RA. $13^h56^m4^s$ Decl. −31° 6′.

1890.375	176.3	0.94	6.5, 7.5	36
.436	179.4	0.97	7 , 8.5	12
.438	180.9	0.66	7 , 8.2	12
1890.41	178.9	0.86	6.8, 8.1	

Discovered wich the 12 inch.

β 1198. τ Herculis.

RA. $16^h16^m8^s$ Decl. +46° 36′.

1890.334	325.3	6.76	4 , 13.5	36
.340	325.1	6.34	4 , 14	36
.356	324.3	6.67	— , 14	36
.373	326.5	6.50	— , 14	36
1890.35	325.3	6.57	— , 13.9	

A very minute companion.

β 1199. Messier 13.

RA. 16^h37^m Decl. +36° 41′.

A and B.

1890.422	131.9	2.64	10.5, 11	36
.458	129.1	2.35	11 , 11.5	36
.460	130.0	2.85	11 , 11.7	36
1890.45	130.3	2.61	10.8, 11.4	

B and C.

1890.422	59°.4	0".84	— , 12	36
.458	59.8	0.96	— , 12.5	36
.460	58.9	0.84	— , 14	36
1890.45	59.4	0.88	— , 12.8	

This is one of the principal stars, and near the central portion, of the great Cluster in Hercules. It was the only pair close enough to be called a double star, I could find on this occasion, but the conditions were not specially favorable. Of course there are many stars within, say, 2″ of each other, but in all of the bright compressed clusters which I have examined with this and other instruments, there seems to be a remarkable absence of real double stars; and this seems to be true of star clusters generally.

β 1200. Lal. 31421.

RA. $17^h11^m5^s$ Decl. +14° 49′.

1890.422	13.5	1.41	8 , 11.5	36
.447	12.7	1.52	7.5, 12.5	36
.458	10.5	1.33	8 , 12.5	36
1890.44	12.6	1.42	7.8, 12.2	

This is the preceding of two 8^m stars, same declination, and 33^s apart. Near α Herculis.

β 1201. AOe. 17215.

RA. $17^h26^m40^s$ Decl. +67° 52′.

1890.463	339.0	0.43	7 , 7	36
.496	337.1	0.39	8 , 8.2	36
.499	338.4	0.48	8.3, 8.3	36
1890.49	338.2	0.43	7.8, 7.8	

β 1202. DM. +3°3564.

RA. $17^h55^m33^s$ Decl. +3° 33.

A and B.

1890.463	351.6	0.75	8 , 9	36
.479	353.5	0.83	8.5, 10	36
.496	354.1	0.65	8 , 9	36
1890.48	353.1	0.74	8.2, 9.3	

C and D.

1890.463	92.2	3.85	8.7, 11.5	36
.479	93.2	3.99	10 , 11	36
.496	94.3	3.89	9.5, 11.5	36
1890.48	93.2	3.91	9.4, 11.3	

AB and C.

1890.463	28.2	104.00	— , —	36
.473	28.4	104.02	— , —	12
.476	28.3	103.73	— , —	36
.479	28.1	103.72	— , —	36
1890.47	28.2	103.87	— , —	

AB and E.

1890.473	138°.4	90″.18	9 , 8.8	12
.476	138.4	90.44	8.5, 8.4	36
.479	138.6	90.34	8.5, 8.4	36
1890.47	138.5	90.32	8.7, 8.5	

A and C are respectively Lamont 2849 and 2852, but the declination of the latter should be 1′ more. The magnitudes of these stars in DM. are the same, 8.2.

β 1203. Serpentis 191.

RA. 18h 19m 56s Decl. +0° 44′.

1890.652	67.4	0.30	7 , 7.3	36
.675	66.9	0.31	8 , 8.2	36
.689	69.1	0.29	7.5, 7.7	36
1890.67	67.8	0.30	7.5, 7.7	

A very close and nearly equal pair. This is Lal. 34015.

β 1204. Aquilae 56.

RA. 19h 6m 1s Decl. +2° 25′.

A and B.

1890.556	3.6	0.51	7 , 8	36
.564	4.6	0.44	8 , 8.5	36
.573	3.3	0.38	8 , 9	36
1890.56	3.8	0.44	7.7, 8.5	

A and C.

1890.553	195.0	12.42	— , 14	36
.556	195.6	12.92	— , 14	36
.573	194.9	13.11	— , 14	36
.610	194.5	13.10	— , 14	36
1890.57	195.0	12.89	— , 14	

A and D.

1890.556	159.9	20.80	— , 14.5	36
.610	160.2	21.54	— , 14.5	36
.675	159.6	21.35	— , 15.5	36
1890.61	159.9	21.23	— , 14.8	

A and E.

1890.556	316.9	26.38	— , 14.5	36
.594	318.0	26.23	— , 14	36
1890.57	317.4	26.30	— , 14.2	

A and F.

1890.553	292.8	27.89	— , 14	36
.556	292.4	27.72	— , 14	36
.594	292.3	27.69	— , 14	36
1890.57	292.5	27.77	— , 14	

A and G. (= Σ 2476).

1890.553	214.0	31.32	7.5, 10.5	36
.556	213.6	31.41	6.8, 10	36
1890.55	213.8	31.36	7.1, 10.2	

Not only is the principal star of Σ 2476 a close double, but there are at least four other stars nearer than the Σ companion. One of these, D, is extremely difficult to measure. There does not seem to be any change in the distant star:

1830.61 214°.7 31″.41 Σ.

β 1205. Lal. 38649.

RA. 20h 5m 46s Decl. −8° 27′.

1890.644	51°.5	0″.51	8 , 9.5	12
.647	49.1	0.57	8.3, 9.5	12
.649	49.3	0.60	8 , 9.2	36
1890.65	50.0	0.56	8.1, 9.4	

Discovered with the 12 inch. In the SD. this star is 7.0 magnitude.

β 1206. Lal. 39115.

RA. 20h 14m 36s Decl. +36° 23′.

1890.518	2.8	1.77	8 , 10.5	36
.523	1.6	2.12	8 , 11	12
.534	4.6	1.80	7.5, 11	36
1890.52	3.0	1.90	7.8, 10.8	

β 1207. Lal. 39198.

RA. 20h 16m 25s Decl. +43° 28′.

1890.573	217.7	5.74	7.5, 13	36
.575	217.1	5.79	8 , 13.5	36
.592	218.7	5.75	7.5, 14	36
1890.58	217.8	5.76	7.7, 13.5	

One of the Wolf-Rayet stars in Cygnus. Perfectly round and sharp with the highest powers.

β 1208. Lal. 39656.

RA. 20h 28m 38s Decl. +6° 28′.

1890.537	335.4	2.77	7.3, 12	36
.556	336.3	3.00	7.5, 12	36
.564	334.8	3.04	7.5, 12.5	36
1890.55	335.5	2.94	7.4, 12.2	

β 1209. SD. −17°.6025.

RA. 20h 34m 9s Decl. −17° 48′.

1890.649	293.8	0.51	9 , 10.5	36
.652	291.4	0.43	9 , 10	36
.673	297.7	0.42	9 , 9.3	36
1890.66	294.3	0.45	9 , 9.9	

Discovered with the 12 inch. It is 22″.4 preceding, and 0″.4 south of the 7m star, B.A.C. 7151.

β 1210. Pi. 20h.440.

RA. 20h 56m 6s Decl. +48° 13′.

A and B.

1890.613	120.5	2.16	7.5, 13	36
.630	118.4	2.35	7.6, 12	36
.633	120.8	2.38	7.7, 12	36
1890.63	119.9	2.30	7.6, 12.3	

C and D. (= $O\Sigma$ 425).

1890.613	133°.8	4".17	11 , 11.5	36
.630	134.1	4.17	10.5, 11	36
.633	134.7	4.49	10.8, 11.1	36
1890.63	134.2	4.28	10.8, 11.2	

A and C. (= $O\Sigma$ 425).

1890.613	28.6	13.89	— , —	36
.630	28.8	13.80	— , —	36
.633	28.4	13.70	— , —	36
1890.63	28.6	13.80	— , —	

The new star, B, is much nearer the principal star than those which constitute $O\Sigma$ 425. The distance of D has never been measured directly before. $O\Sigma$ gives the distance of CD, derived from the angles, in connection with the measures of AC, as 4".11 (1851.7). There has probably been no change in these stars unless the distance of C has increased. The following are all the measures:

1847.49	27°.6	12".33	$O\Sigma$	3 n.
1867.00	29.9	12.72	De	3 n.

β 1211. Lal. 40744.

RA. 20h 57m 15s Decl. —18° 35'.

1890.644	343.8	0.65	8 , 8.3	36
.649	345.6	0.58	7.5, 8	36
.652	344.6	0.50	7 , 8	36
1890.65	344.7	0.58	7.5, 8.1	

The following of a small triangle; discovered with the 12 inch.

β 1212. 24 Aquarii.

RA. 21h 33m 20s Decl. —0° 36'.

1890.725	256.5	0.44	6.8, 7.5	36
.760	254.9	0.45	6.5, 6.7	36
.777	252.0	0.45	6.2, 6.5	36
1890.75	254.5	0.45	6.5, 6.9	

A fine moderately close pair, and it is safe to say at the outset that it will prove to be a binary. The proper motion of this star is 0".215 in the direction of 81°.5, and it is evident that it is common to both stars.

β 1213. DM. +12°.4710.

RA. 21h 48m 26s Decl. +13° 0'.

A and B.

1890.675	258.7	62.21	8 , —	36
.678	258.9	62.40	8 , —	36
.709	258.8	62.25	8 , —	36
1890.69	258.8	62.29	8 , —	

B and C.

1890.675	312°.7	0".91	9 3 , 9.6	36
.678	311.5	0.75	9 , 9.5	36
.709	311.5	0.78	9 , 9.5	36
1890.69	311.9	0.81	9.1 , 9.5	

I found this triple with the Chicago refractor in 1884, but it has not been given in any of my previous lists of new pairs.

β 1214. DM. +33°.4387.

RA. 21h 51m 23s Decl. +33° 45'.

A and B.

1890.633	205.8	1.44	9 , 10.3	36
.652	204.3	1.33	9 , 10.5	36
.673	204.8	1.40	9 , 10	36
1890.65	205.0	1.39	9 , 10.3	

C and D.

1890.633	246.3	5.07	10.5, 11	36
.652	245.6	4.98	9.5, 10.8	36
.673	245.6	5.12	9.3, 10.5	36
1890.65	245.8	5.06	9.8, 10.8	

A and C.

1890.633	18.4	112.16	— , —	36
.652	18.1	112.55	— , —	36
.673	18.5	112.58	— , —	36
1890.65	18.3	112.43	— , —	

This quadruple star was noted by me in 1884, but is not included in any of my previous catalogues. There is a faint star about 20" from C in the direction of 285°; and a 5" pair of faint stars between AB and CD. A good many smaller stars in the field. C is No. 4388 of the DM.; magnitude 9.3.

β 1215. SD. —11°.5781.

RA. 22h 6m 46s Decl. —11° 46'.

1890.802	89.7	1.58	9 , 9	36
.824	90.0	1.53	9 , 9.1	36
.840	90.9	1.49	9 , 9	36
1890.82	90.2	1.53	9 , 9	

Near the last pair; discovered with the 12 inch.

β 1216. Lal. 43605.

RA. 22h 14m 41s Decl. +28° 55'.

1890.496	318.6	0.65	8.3, 8.5	36
.518	316.1	0.68	8.5, 9	36
.526	318.5	0.60	8.5, 8.5	36
1890.51	317.7	0.64	8.4, 8.7	

I found this pair Sept. 3, 1885 with the 16 inch refractor of the Warner Observatory during an evening spent with Dr. Swift at that place. Recently the slip of paper containing a memorandum of the place of the star was found, and it is now measured for the first time.

β 1217. Lal. 43635.
RA. $22^h15^m33^s$ Decl. $+30°42'$.

1890.499	216°8	0".68	7.3, 9.5	36
.518	221.6	0.65	7.5, 10	36
.564	218.3	0.50	7.5, 11.5	36
1890.53	218.9	0.61	7.4, 10.3	

This pair has proved exceedingly troublesome to measure. On several occasions when the seeing appeared to be excellent there was not the least trace of the companion. The magnitude in DM. is 7.0.

β 1218. W_2 22^h476.
RA. $22^h22^m32^s$ Decl. $+29°5'$.

1890.523	51.7	1.48	8.7, 8.9	12
.526	54.0	1.44	8.6, 8.8	36
.534	54.8	1.40	8.5, 8.8	36
1890.52	53.5	1.44	8.6, 8.8	

Discovered with the 12 inch.

β 1219. SD. $-11°5931$.
RA. $22^h42^m27^s$ Decl. $-11°42'$.

1890.802	310.0	0.56	8.7, 9.2	36
.824	309.3	0.55	8.8, 9.5	36
.840	304.3	0.52	8.7, 9.5	36
1890.82	307.9	0.54	8.7, 9.4	

This is a difficult pair, although it was discovered with the 12 inch. About 5' np there is a 6" pair.

β 1220. ψ^1 Aquarii.
RA. $23^h9^m35^s$ Decl. $-9°44'$.

B and C.

1889.689	267.1	0.14	—, —	36
1890.610	96.2	0.20	9.5, 9.6	36
.630	109.2	0.25	9.0, 9.1	36
.633	—	0.22	9.0, 9.1	36
.660	97.7	0.23	9, 9	36
1890.63	101.1	0.22	9.1, 9.2	

A and BC. (Σ 12, App. II).

1889.673	311.8	49.27	—, —	36
.687	311.8	49.25	—, —	36
.689	311.8	49.48	—, —	36
1889.68	311.8	49.33	—, —	

I found in 1889 that the Herschel-Struve companion was a close double star, but was able to get but a single measure that year. It seemed to be much easier the following year, and the difference of the components in magnitude was obvious. The late measures indicate a considerable increase in the angle as well as in the distance. The mean result given above includes only the measures of 1890. The micrometer was disturbed during the night on which the last measure but one was made, and the position-angle was, therefore, lost.

This star has remained absolutely fixed with reference to ψ^1 since the measures by Struve. The large star has a considerable proper motion, given as 0".350 annually in the direction of 89°8, and this is evidently common to both stars. It is not unlikely that this will prove to be a triple system of the class of which μ Herculis and μ Bootis are familiar examples, with the close pair in rapid orbital motion. It is probably a difficult object at all times, or it would have been detected by some of the many observers who have measured the wide pair. In 1880 I made a set of measures with the Chicago 18.5 inch, but saw nothing of the close pair.

β 1221. DM. $+41°4788$.
RA. $23^h22^m12^s$ Decl. $+41°46'$.

1890.496	145°7	1".93	9.5, 10.5	36
.499	144.7	1.91	9.5, 10.5	36
.518	145.2	1.89	9, 10.5	36
1890.50	145.2	1.91	9.3, 10.5	

Discovered by me at the Warner Observatory in 1885 on the occasion referred to in the note to No. 1216 of this list.

β 1222. DM. $+2°4669$.
RA. $23^h22^m23^s$ Decl. $+2°54'$.

1890.802	37.3	1.23	9.2, 9.3	36
.824	37.4	1.07	8.6, 8.7	36
.840	37.5	1.13	9.0, 9.0	36
1890.82	37.4	1.14	8.9, 9.0	

Discovered with the 12 inch.

β 1223. DM. $+4°5046$.
RA. $23^h39^m10^s$ Decl. $+4°27'$.

1890.802	297.0	1.35	8, 11	36
.824	298.9	1.34	8.5, 11	36
.840	299.9	1.30	7.7, 10.5	36
1890.82	298.6	1.33	8.1, 10.8	

Discovered with the 12 inch.

β 1224. Lal. 46942.
RA. $23^h50^m52^s$ Decl. $+55°10'$.

1890.725	200.9	3.98	6.7, 13	36
.747	204.8	3.94	6.7, 13.5	36
.760	204.2	3.90	6.5, 13.5	36
1890.74	203.3	3.94	6.6, 13.3	

The magnitude of this star in the DM. is 7.5.

Measures of Double Stars.

Σ 2.

RA. $0^h 2^m 36^s$ Decl. +79° 3′.

1890.785	173°.1	0″.27	7 , 7	36
.802	179.9	0.30	6.6 , 6.6	36
.879	178.3	0.30	6.5 , 6.8	36
1890.82	177.1	0.29	6.7 , 6.8	

This pair has been single, or non-measurable for the last thirty years. The angular motion since the last measure of *OΣ* in 1858 has been more than 150°. It is not a difficult pair now, and the distance should be steadily increasing, with but little change in the angle. The measures indicate a period of about 450 years, with a maximum distance of 1″.

β 484.

RA. $0^h 3^m 30^s$ Decl. +51° 22′.

1890.898	153.0	1.88	7.5 , 11.5	36
.900	156.2	2.01	7.7 , 11.5	36
.911	154.6	1.84	7.8 , 12	36
1890.90	154.6	1.91	7.7 , 11.7	

The only other measures of this pair are:

1878.66 156°.3 1″.95 β 2 n.

β 255.

RA. $0^h 5^m 38^s$ Decl. +27° 45′.

1890.862	96.7	0.70	7.5 , 8	36
.879	99.0	0.53	7.5 , 9	36
.882	97.9	0.53	7.6 , 8.3	36
1890.87	97.9	0.59	7.5 , 8.4	

Probably not much change yet, as De found:

1875.76 99°.0 0″.38 De 4 n.

β 393.

RA. $0^h 12^m 12^s$ Decl. −21° 48′.

1890.879	18.4	0.70	7.6 , 8	36
.893	17.5	0.73	7.5 , 8	36
.898	12.1	0.71	7.5 , 8.3	36
1890.89	16.0	0.71	7.5 , 8.1	

Change is uncertain.

OΣ 10 rej.

RA. $0^h 21^m 16^s$ Decl. +15° 22′.

1890.785 Neither star double. Good seeing. 36

The smaller star of this wide pair (237°: 96″) at one time was supposed to be a close pair, but it was rejected by *OΣ* in the catalogue of 1850. Ma in 1844 made a measure of it, marked »very uncertain«. I found it single in 1878 with the 18½ inch, and at other times. Clearly there is no occasion for any further examination of this star.

H. 1968.

RA. $0^h 21^m 33^s$ Decl. −17° 4.

1890.851	88°.4	4″.19	7 , 9.5	36
.854	86.1	4.17	7 , 9.3	12
.856	88.3	3.75	7.8 , 9.5	12
.867	88.4	3.80	8 , 10.5	12
1890.86	87.8	3.98	7.5 , 9.7	

The proper motion of this star (Lal. 593) is given as 0″.252 in the direction of 92°. If the direction and amount of this motion is correct, the measures of this pair show that the small star has a proper motion of its own of 0″.18 per annum in the direction of 195°.5, nearly at right angles to the motion of the other star. On the other hand, if B is fixed in space, then the correct proper motion of A is 0″.35 in the direction of 61°.2. An extended examination of these motions will be found in a paper by the present writer in Monthly Notices for January, 1891.

Ho. 212. 13 Ceti.

RA. $0^h 29^m 3^s$ Decl. −4° 15′.

1890.785 Cannot see any trace of duplicity in the large star. Tried all powers; seeing fairly good. 36

Hough, with the Chicago refractor, thought this was a close pair, (90°: 0″.3), but I could see nothing of it.

OΣ 15.

RA. $0^h 29^m 14^s$ Decl. +48° 22′.

1890.879	122.9	0.20	7.5 , 8.5	36
.882	121.0	0.11	7 , 8.5	36
.898	121.0	0.15	7.3 , 8	36
1890.88	121.6	0.15	7.3 , 8.3	

This star seems to have been rejected by *OΣ* as being really single. Apparently no one but Mädler has ever seen it double. He gave, 97°.3: 0.3± (1851.7), and noted it as single the following year. It was very doubtful to De, 1865. I could see no certain elongation with the Hanover 9.4 inch in 1874, and found it single with the Chicago 18½ inch 1879, and had come to the conclusion that it was not a double star. Even if there has been no change, the closeness of the components would account for the failures heretofore to see it double. (See A.N. 3017).

β 395.

RA. $0^h 31^m 9^s$ Decl. −25° 26′.

1890.802	114.4	0.77	6 , 6.1	36
.824	111.4	0.75	6 , 6.2	36
.832	111.9	0.69	6 , 6	36
1890.82	112.6	0.74	6 , 6.1	

Certainly a binary, but the motion is slow. This star has a large proper motion, which, according to Argelander, is 1″.436 in the direction of 90°.3.

β 491. δ Andromedae.

RA. $0^h 32^m 54^s$ Decl. $+30° 12'$.

1890.556	299°5	28".26	—, 12	36
.564	299.2	28.07	—, 12.5	36
.573	299.6	28.22	—, —	36
1890.56	299.4	28.18	—, —	

No change since my first measures.

$O\Sigma$ 515. φ Andromedae.

RA. $1^h 2^m 32^s$ Decl. $+46° 36'$.

1890.575	249.6	0.30	5, 6	36
.594	247.8	0.30	—, —	36
.610	255.0	0.36	—, —	36
1890.59	250.8	0.32	—, —	

Ho. 215. 45 Andromedae.

RA. $1^h 4^m 26^s$ Decl. $+37° 5'$.

1890.630	Not double.	36
.660	Absolutely round with powers to 1500, and fine conditions. Cannot be double.	36
.675	Perfectly round. Seeing magnificent.	36

Ho. gave the angle 259°1 (1889.97) 1 n. There is probably some mistake about this star, as it would be a very easy pair with this telescope according to the description in Ho.

β 1029. ζ Piscium.

RA. $1^h 7^m 27^s$ Decl. $+6° 56'$.

B and C.

1890.903	249.4	0.75	—, 13.5	36
.911	248.6	1.02	—, 13.5	36
.939	248.5	0.77	—, 13.5	36
1890.92	248.8	0.85	—, 13.5	

A and B. (Σ 100).

1890.911	63.2	23.76	—, —	36
.939	63.9	23.65	—, —	36
1890.92	63.5	23.70	—, —	

There does not seem to be any change in the small star since my measures in 1888.

Polaris.

RA. $1^h 14^m 46^s$ Decl. $+88° 40'$.

A and C.

1890.785	83.0	44.70	—, 14.5	36
.802	83.7	44.67	—, 15.5	36
1890.79	83.3	44.68	—, 15	

A and D.

1890.785	169°2	82".80	—, 14	36
.802	170.7	82.86	—, 14	36
1890.79	170.0	82.83	—, 14	

In 1884 I examined Polaris with the Chicago refracto and measured the places of the nearest stars I could se with that instrument. The measures, which have never bee published, are as follows:

1884.74	88°0	43".28	—, 13	1 n.
1884.74	172.2	82.68	—, 12	1 n.

These are small stars with the 36 inch. There nothing nearer than the Σ companion.

β 4.

RA. $1^h 14^m 59^s$ Decl. $+10° 55'$.

1890.851	69.6	0.41	8, 9	36
.879	69.7	0.40	7.5, 8.5	36
.882	67.2	0.42	7.5, 8.5	36
.903	70.2	0.38	8, 9	36
1890.88	69.2	0.40	7.8, 8.8	

Some of the measures made heretofore are ver discordant, and would appear to indicate rapid motion but it is now quite certain that the change is rather slow Both angle and distance seem to be diminishing.

β 506. η Piscium.

RA. $1^h 25^m 4^s$ Decl. $+14° 44'$.

1890.725	13.0	0.95	—, 11.5	36
.777	16.0	1.02	—, 10.5	36
.840	14.1	1.01	—, 11	36
1890.78	14.8	0.99	—, 11	

H. 2061.

RA. $1^h 30^m 2^s$ Decl. $-18° 8'$.

1890.936	322.7	63.13	7.5, 9.5	36
.939	322.2	62.98	7.5, 10	36
1890.94	322.4	63.05	7.5, 9.7	

This star has a large proper motion, 0".414 in th direction of 116°5. There are no other measures of th companion with which to compare these. Herschel gav the angle 326°7, and estimated distance 30". Evidentl there would be but little change in the angle.

β 736.

RA. $1^h 39^m 38^s$ Decl. $+38° 20'$.

A and B.

1890.898	209.4	0.75	8.5, 11	36
.900	208.3	0.80	8.5, 11	36
.911	210.2	0.75	8.5, 11	36
1890.90	209.3	0.77	8.5, 11	

A and C. (Σ 157).

1890.898	116°6	12".63	—, 8.6	36
.900	115.6	12.59	—, 8.7	36
.911	115.5	12.46	—, 8.7	36
1890.90	115.9	12.56	—, 8.7	

There is no change in the wide pair since the measures of Σ in 1832. The close pair was discovered with the 6 inch on Mt. Hamilton in 1879. These are the only other measures:

1879.94 209°0 0".86 β 3 n.

β 1016.

RA. $1^h42^m52^s$ Decl. +32° 29'.

1890.898	27.1	0.59	8.5, 8.5	36
.900	28.0	0.56	8.5, 8.5	36
.911	28.4	0.63	8.5, 8.5	36
1890.90	27.8	0.59	8.5, 8.5	

There are no other measures of this pair.

Ho. —.

RA. $1^h44^m32^s$ Decl. +24° 4'.

1890.903	179.3	0.36	8, 8.2	36
.911	176.9	0.39	7, 7.1	36
.939	176 3	0.35	7.5, 7.7	36
1890.92	177.5	0.37	7.5, 7.7	

Discovered by Hough. From Gould's Journal, No. 215.

β 512.

RA. $1^h47^m12^s$ Decl. +18° 42'.

1890.564	25.8	1.60	8, 12.5	36
.573	24.0	1.69	8.7, 11	36
.610	21.5	1.64	9, 11.5	36
1890.58	23.8	1.64	8.6, 11.7	

This star is the distant companion to γ Arietis, measured by Sh. The only other measures of this pair are:

1878.01 27°3 1".45 β 2 n.

Σ 186.

RA. $1^h49^m41^s$ Decl. +1° 15'.

1890.879	229.4	0.33	7.5, 7.5	36
.882	225.8	0.32	6.5, 6.5	36
.890	226.1	0.28	—, —	36
1890.88	227.1	0.31	7.0, 7.0	

The angular motion has been about 160° since 1831. Some of the measures are very discordant. The period cannot be less than 120 years. (Sidereal Messenger, February, 1891).

β 513. 48 Cassiopeiae.

RA. $1^h52^m7^s$ Decl. +70° 19'.

1890.594	309°1	0".60	5, 7.5
.610	309.9	0.48	—, —
.633	306.6	0.58	—, —
.652	308.7	0.56	—, —
1890.62	308.6	0.55	—, —

This will soon be a very difficult object. will be principally in distance, and in a few probably be out of the reach of the large tele measures down to this time indicate a perio less than 40 years.

$O\Sigma$ 38. γ Andromedae.

RA. $1^h56^m32^s$ Decl. +41° 45'.

B and C.

1890.526 Elongation doubtful with 190 Distance much less than 0".1.

.573 Seems to be slightly elongated 304°6. Distance decidedly le than 0".1.

.594 Elongation, if any, too uncerta to measure with the highest powe

.660 Tried with all powers, and th elongation, if any, is so slight th any measure would have no valu Seeing magnificent, and the st nearly in the zenith.

It will probably be several years befo separates sufficiently to be fairly measurable wit instruments. When the distance is not less set of measures can be made which will giv with general accuracy, when taken in connect old measures.

Hastings.

RA. $2^h10^m3^s$ Decl. —18° 47'.

1890.939	342.3	2.26	8, 8.2
.955	341.6	2.27	8, 8.3
.974	340.3	2.11	8, 8.4
1890.95	341.4	2.21	8, 8.3

The change in this pair is clearly the res motion, but this does not correspond to the p derived from the meridian observations whi 0".24 in the direction of 186°. Considering the apparent motion of B is about 0".1 ann direction of 54°. These stars are probably si components of 61 Cygni, and have each a diff motion.

Mira Ceti.

RA. $2^h13^m17^s$ Decl. —3° 31'.

1890.709	87.9	73.70	—, 12.5
.840	88.4	74.18	—, 13
1890.77	88.1	73.94	—, 12.7

I found this faint star at Chicago. It is between the variable and Herschel's companion. The only other measures are:

1878.88 90°.0 74".70 β 2 n.

H. 3498.

RA. $2^h 16^m 43^s$ Decl. −28° 25′.

1890.840 No companion of any kind seen. 36
Good seeing.

H gave the magnitudes 7 and 16, and the distance 10"±, with the note, »Triple? Excessively difficult«. The principal star is Lac. 711.

β 740.

RA. $2^h 40^m 29^s$ Decl. +29° 11′.

1890.652 Large star certainly not double. 36
.840 Not double. Both stars round. 36

As a wide pair this is β 307. Subsequently I examined it with the 6 inch, and thought the large star was a very close double. This is probably not the case.

H. 3535.

RA. $2^h 44^m 42^s$ Decl. −28° 26′.

1890.832 Not double. 36

This star, B.A.C. 883, Herschel thought was a close pair. I have never been able to see, nor has any one else, so far as I know, except that it was noted as elongated by Wilson at Cincinnati. I do not think it can be really double.

β 524. 20 Persei.

RA. $2^h 46^m 9^s$ Decl. +37° 51′.

A and B.

1890.594	287°.5	0".17	5 , 6	36
.610	288.0	0.20	5 , 6	36
.630	287.2	0.17	— , —	36
1890.61	287.6	0.18	5 , 6	

AB and C. (Σ 318).

1890.594	237.5	14.07	— , 9.0	36
.610	237.1	14.06	— , 9.5	36
.630	237.1	14.10	— , —	36
1890.61	237.2	14.08	— , 9.2	

The close pair is in rapid motion. The change in angle is about 50° since 1878. The distance is steadily decreasing.

β 525. B.A.C. 920.

RA. $2^h 52^m 0^s$ Decl. +21° 8′.

1890.851	123.2	0.36	6.7 , 6.8	36
.867	120.1	0.31	7.5 , 7.5	36
.879	303.2	0.32	7.5 , 7.6	36
1890.87	122.2	0.33	7.2 , 7.3	

The distance has certainly diminished since I found this pair in 1875, and the angle seems to be slowly increasing. It is a binary beyond question.

Algol.

RA. $3^h 0^m 21^s$ Decl. +40° 30′.

1890.660 At first a suspicion of a slight elongation with 2600 in a nearly north and south direction, but too vague to place any reliance on. First class night. $0^h 15^m$ S. T. 36

.687 Star appears symmetrical under all powers. $23^h 50^m$ S. T. 36

None of the stars which have been supposed from spectroscopic observations, to be close doubles have shown any evidence of the fact when examined with the large telescope under the most favorable conditions. It is possible that some other explanation will be found for the recurrent phenomenon first discovered by Miss Maury in the Harvard spectrum photographs. At all events, it is hardly worth while, until the method has been verified upon some of the numerous known pairs suitable for this purpose, to consume the valuable time of the great telescope in a further examination of objects of this class.

β 84.

RA. $3^h 10^m 5^s$ Decl. −6° 22′.

1890.882	28°.0	0".72	6.7 , 7.2	36
.890	30.2	0.66	6.5 , 6.6	36
.893	24.7	0.75	7.0 , 7.5	36
.906	26.2	0.78	7.0 , 8.0	36
1890.89	27.3	0.73	6.8 , 7.3	

This pair is much easier now than it was when I found it with the 6 inch in 1872. It is not certain that there has been much change in the angle.

1875.85 10°.3 0".44 De 5 n.
1879.39 32.4 0.72 β 5 n.

A.C. 2. 95 Ceti.

RA. $3^h 12^m 12^s$ Decl. −1° 22′.

1890.882 Nothing seen of the companion. 36
Good seeing.

.867 Tried all powers with favorable conditions, but the small star could not be seen. 36

This is the most mysterious and strange double star in the heavens. I have tried it, first and last, perhaps hundreds of times with apertures all the way from 6 to 36 inches without being able to see any trace of the little star. At the time of its discovery by Alvan Clark with a 7 1/2 inch refrator, the distance was 0".7, and the angle was measured by Dawes in 1854. In 1888 I got two measures of it with this telescope, but it was very difficult, the distance being 0".45. If the small star is not variable, and it is not at all probable that it is, it must be in very rapid motion. I hope to watch it carefully here after. A new pair was found in a low power field with this star, which is given in the accompanying list of new stars (β 1177).

β 878. 66 Arietis.

RA. $3^h 21^m 26^s$ Decl. $+22° 23'$.

1890.882	79°.7	1".40	6 , 13.5	36
.890	72.9	1.25	6 , 13.5	36
.898	75.8	1.23	5.5 , 14	36
1890.89	76.1	1.29	5.8 , 13.7	

The only other measures are:

1881.06 78°.0 1".10 β 2 n.

β 536.

RA. $3^h 39^m 8^s$ Decl. $+23° 49'$.

1890.689	317.7	0.22	8 , 8.5	36
.867	325.1	0.14	8 , 8.5	36
.879	324.3	0.21	8 , 8.5	36
1890.81	322.4	0.19	8 , 8.5	

This is one of the stars in the Pleiades, and is the principal star of the wide pair, S 437. It is $1^m 13^s$ preceding Alcyone, and 4' 52" north. The change has been principally in distance, and it is now a difficult pair. The only other measure is:

1878.69 336°.4 0".44 β 3 n.

β 537.

RA. $3^h 39^m 53^s$ Decl. $+24° 28'$.

1890.879	185.8	0.45	8.5 , 10.5	36
.882	186.0	0.44	8.2 , 9.5	36
.890	182.5	0.55	8.5 , 9.5	36
1890.88	184.8	0.48	8.4 , 9.8	

This is also in the Pleiades. Probably unchanged.

1877.91 185°.9 0".60 β 3 n.

H. 338. 30 Eridani.

RA. $3^h 46^m 47^s$ Decl. $-5° 43'$.

1890.867 Large star certainly single. 36

De thought the large star elongated in 165°. I always found it round with the 6 inch, and it is surely single now.

β 545.

RA. $3^h 59^m 24^s$ Decl. $+37° 42'$.

1890.775	310.6	1.17	8 , 10.5	36
.785	311.5	1.05	8 , 10	36
.802	309.6	1.18	8 , 11	36
.824	308.8	0.97	8 , 10.8	36
1890.79	310.1	1.09	8 , 10.6	

β 545 and $O\Sigma$ 531.

1890.775	208.1	235.60	— , —	36
.785	208.2	235.43	— , —	36
1890.78	208.1	235.51	— , —	

β 545 is the star used for measuring the parallax of $O\Sigma$ 531, the latter having the same proper motion as 50 Persei. $O\Sigma$ suspected the latter to have a very minute companion. The 36 inch failed to show any near attendant. There is probably no change in the pair above measured.

1878.24 310°.0 1".02 β 4 n.

Σ 518. 40 Eridani.

RA. $4^h 9^m 52^s$ Decl. $-7° 47'$.

1890.681	99°.5	2".73	— , —	36
.709	99.0	2.80	— , —	36
.760	100.9	2.43	— , —	36
.775	100.4	2.75	— , —	36
1890.73	100.0	2.68	— , —	

$O\Sigma$ 79. 55 Tauri.

RA. $4^h 13^m 2^s$ Decl. $+16° 14'$.

1890.660	85.7	0.35	7 , 8	36
.673	89.8	0.48	6 , 7.5	36
.675	89.6	0.36	6 , 7.5	36
.681	86.6	0.35	6.5 , 7.5	36
1890.67	87.9	0.38	6.4 , 7.6	

Certainly a binary, but the period will be rather long. The angular movement has been 63° since 1846.

71 Tauri.

RA. $4^h 19^m 30^s$ Decl. $+15° 21'$.

1890.681 Certainly not double. 36

This star was suspected to be a close pair by the observers at Cambridge. I have examined it a good many times with various instruments, but never saw anything suspicious. I do not think it is worth while following this up any longer.

Σ 547.

RA. $4^h 19^m 48^s$ Decl. $-1° 40'$.

1890.802	28.9	2.07	8.5 , 9.5	36
.824	28.3	1.92	8.3 , 9.5	36
.832	28.3	2.05	8.7 , 10	36
1890.82	28.5	2.01	8.5 , 9.7	

The change in this pair is due to proper motion (See Observatory, Jan. 1891). The apparent annual movement of the small star is 0".052 in the direction of 137°.8.

Σ 554. 80 Tauri.

RA. $4^h 23^m 17^s$ Decl. $+15° 23'$.

1890.879 Single with all powers. 36

It was examined on several other nights with the same result.

β 550. Aldebaran.
RA. $4^h 29^m 2^s$ Decl. +16° 16′.

A and B.

1890.856	108°.5	31″.40	— , 14	36
.862	109.9	31.37	— , 14	36
.890	108.6	31.24	— , 14.5	36
1890.87	109.0	31.34	— , 14.2	

C and D. (β 1031).

1890.851	278.9	1.78	11 , 13	36
.862	277.5	2.08	— , —	36
.867	281.3	1.94	11 , 13.5	36
.882	278.6	1.57	11 , 14	36
1890.86	279.1	1.84	11 , 13.5	

A and C. (Σ 2, App. II).

1890.854	34.4	117.36	— , —	12
.856	34.1	117.19	— , —	12
.862	34.6	116.98	— , —	36
.867	34.3	116.55	— , —	36
1890.86	34.3	117.02	— , —	

The measures show that B has the same proper motion as Aldebaran; and also that C has a proper motion of its own of 0″.095 in the direction of 109°.6. D appears to be moving with C. For a full examination of the various measures of these stars and their motions, see paper by the present writer in Monthly Notices for March 1891.

β 883.
RA. $4^h 44^m 33^s$ Decl. +10° 52′.

A and C.

1891.052	152.2	18.22	6.8, 13	36

I have looked at this star a number of times without seeing any trace of the close pair, so that there is no doubt of rapid change. The only measures are:

1879.00	17°.5	0″.35	β 1 n	A and B.
1879.00	148.5	18.35	β 1 n	AB and C.

β 552.
RA. $4^h 45^m 3^s$ Decl. +13° 27′.

1890.898	154.3	0.30	6.8, 10	36
0.939	160.2	0.39	6.8, 10.5	36
1.055	155.5	0.30	7 , 10	36
1890.96	156.7	0.33	6.9, 10.2	

This was discovered with the Chicago telescope in 1877. It was not measured, but the distance was estimated 0″.8, and the position-angle 360°, the magnitudes being given as 7 and 10. There has been a wonderful change in the distance, and it is now one of the most difficult pairs I have measured with the large telescope. I have examined the original record made at the time of th discovery, and there is no reason for supposing that a error of 180° was made in estimating the angle. If i was correctly put down, there has been rapid motion i the angle as well as the distance. It is more than pro bable that it will prove to be a very rapid binary.

De 5. 7 Camelopardi.
RA. $4^h 47^m 41^s$ Decl. +53° 34′.

A and B.

1890.775	297°.9	1″.05	— , 10.5	36
.777	301.5	1.03	5.5, 10	36
.785	306.8	1.04	— , 10	36
1890.77	302.1	1.04	— , 10.2	

Discovered by De in 1864. There is little, if any change.

1865.33 309°.1 1″.24 De 8 n.

The distant star which makes Σ 610 is relatively fixed.

β 555. β Orionis.
RA. $5^h 8^m 47^s$ Decl. −8° 20′.

B and C.

1890.775	Small star appears to be single with all powers.	36
.829	Small star absolutely round with all powers.	36
.840	Carefully examined with all powers up to the highest. No indication of duplicity.	36
.890	Fine seeing. B is round.	36

This star has resisted all recent attempts to resolve or elongate it. It may not be double after all, but should be watched for a few years longer.

β 190. Orionis 82.
RA. $5^h 14^m 38^s$ Decl. −8° 9′.

A and B.

1890.939	359.9	0.50	8 , 8.1	36
0.955	359.9	0.61	8 , 8.1	36
1.055	355.6	0.52	— , —	36
1890.98	358.5	0.54	8 , 8.1	

AB and C. (Σ 692).

1890.939	4.2	34.82	— , 8.7	36
1.052	3.6	34.97	— , —	36
1890.99	3.9	34.90	— , —	

The close pair was discovered with the 6 inch in 1874. The Σ companion is fixed, and there is not much change in the new pair:

1876.15 355°.3 0″.71 De 4 n.

β 888. σ Aurigae.

RA. $5^h 16^m 29^s$ Decl. +37° 17′.

1890.936	167°.2	8″.64	6 , 13.5	36
0.939	168.1	8.69	6 , 13	36
1.033	166.1	8.46	— , 13	36
1890.97	167.1	8.60	6 , 13.2	

There would seem to be a change in the distance. The following are the only other measures:

1880.14 171°.0 7″.91 β 4 n.

Σ 711.

RA. $5^h 21^m 38^s$ Decl. +54° 35′.

1890.838 Fine seeing; nothing seen of any third star. 36

.840 Both stars round. Certainly not double. 36

In 1865 De. thought the larger star was double.

β 557.

RA. $5^h 23^m 16^s$ Decl. +3° 3′.

B and C.

1890.882	148.5	0.38	9 , 9	36
.890	145.7	0.35	9 , 9	36
.939	147.8	0.35	9 , 9	36
1890.90	147.3	0.36	9 , 9	

A and BC. (Σ 721).

1890.890	150.1	24.55	— , 7.5	36
.939	149.5	24.68	— , 7.6	36
1890.91	149.8	24.61	— , —	

There is no change in the Σ pair. The only other measure of the close pair is:

1878.16 142°.4 0″.46 β 2 n.

β 1032. σ Orionis.

RA. $5^h 32^m 43^s$ Decl. −2° 40′.

1890.785	348.6	0.31	4 , 5	36
.829	351.6	0.30	— , —	36
.832	354.6	0.25	— , —	36
1890.81	351.6	0.29	— , —	

The first set of measures gives:

1888.81 357°.0 0″.26 β 4 n.

β 1007. 126 Tauri.

RA. $5^h 34^m 22^s$ Decl. +16° 28′.

1890.785 Single with 1000. 36

I have not tried this star before since I found it with the 12 inch on Mt. Hamilton in 1881.

β 752.

RA. $5^h 39^m$ Decl. +47° 46′.

1890.660 This star is certainly not double. 36

This was suspected to be a very close pair with the 6 inch on Mt. Hamilton in 1879.

β 1056. μ Orionis.

RA. $5^h 55^m 47^s$ Decl. +9° 39′.

1890.775	272°.4	17″.01	4 , 14	36
.840	273.1	17.17	4 , 15	36
.974	272.5	17.15	— , 13.5	36
1890.86	272.7	17.11	— , 14.2	

β 1058. 4 Geminorum.

RA. $6^h 3^m 13^s$ Decl. +23° 1′.

1890.939	283.0	0.27	6.1 , 6.2	36
1.052	277.7	0.27	6.5 , 6.6	36
1.055	283.3	0.31	6.3 , 6.5	36
1891.01	281.3	0.28	6.3 , 6.4	

Comparing these measures with those of last year, a change in the distance seems probable.

1889.13 104°.3 0″.41 β 2 n.

β 1008. η Geminorum.

RA. $6^h 7^m 38^s$ Decl. +22° 32′.

1890.903	295.3	1.12	3.5 , 11	36
.939	295.5	1.11	— , 11	36
.955	297.6	1.02	— , 10	36
1890.93	296.1	1.08	— , 10.7	

Ho. 237.

RA. $6^h 35^m 47^s$ Decl. +3° 22′.

1890.939 No double star found here. All the stars round. 36

Ho. describes this as an equal pair of 7″.5 stars, with a distance of 0″.3. There is certainly no double star in or near this place. All the stars in the vicinity were examined.

A.G.C. 1. Sirius.

RA. $6^h 39^m 53^s$ Decl. −16° 33′.

1890.252	359.6	4.17	— , —	36
.269	361.6	4.20	— , —	36
.304	356.8	4.19	— , —	36
1890.27	359.7	4.19	— , —	

1890 785. The seeing seems to be very good, and although Sirius is perhaps an hour and a half from the meridian, apparently the companion should be seen if it can be seen at all this year.

1890.829. Followed it a long time, using various powers but could not see anything of the companion. The seeing is excellent.

1890.840. Followed Sirius for some time under favorable conditions. The companion could not be seen.

1890.939. Fine seeing. Tried all powers; no trace of the small star.

I am surprised to find that the companion has passed beyond the reach of the large telescope. I had supposed that it would be measurable even at the minimum distance if the theory of its movement is substantially correct. It will probably not be seen again for several years. The measures given above were made with great difficulty. In consequence of my absence on the eclipse expedition, the measures were delayed two or three months beyond the usual time, and Sirius was long past meridian when these observations were made. The present indications are that the period will probably not be more than 53 years. I have recently compiled a complete list of the measures of the companion down to this time which will be found in Monthly Notices for April 1891.

β 756.

RA. $6^h 41^m$ Decl. $+39° 35'$.

1890.785 No double found in or near this place. 36

This star was suspected to be a close pair with the 6 inch.

$O\Sigma$ 165. 45 Geminorum.

RA. $7^h 1^m 29^s$ Decl. $+16° 9'$.

1890.939	54°0	3".29	6 , 13	36
.955	51.5	3.35	6 , 12	36
.974	53.5	3.12	6 , 12.5	36
1890.96	53.0	3.25	6 , 12.5	

The change in this pair is due to proper motion. The apparent motion of B is about 0".1 per annum in the direction of 358°.4.

β 1009. τ Geminorum.

RA. $7^h 3^m 30^s$ Decl. $+30° 26'$.

1980.903	177.0	1.75	4.5 , 12.5	36
0.939	180.9	1.94	— , 14	36
0.955	173.9	1.51	— , 13.5	36
1.052	178.6	1.79	— , 13	36
1890.96	177.6	1.75	— , 13.2	

There has been no material change in this pair since my measures in 1882.

$O\Sigma$ 171.

RA. $7^h 18^m 53^s$ Decl. $+31° 52'$.

1890.890	130.0	1.16	7.5 , 9	36
.903	130.4	1.19	7.8 , 10.5	36
.936	132.4	1.04	8 , 9.5	36
1890.91	130.9	1.13	7.8 , 9.7	

There is very little, if any, change in this pair since the first measures.

β 22.

RA. $7^h 25^m 30^s$ Decl. $+33° 7'$.

1890.898	150°5	6".46	8.3 , 9.5	36
.903	150.3	6.55	8 , 10	36
.936	150.3	6.24	8.5 , 10.5	36
1890.91	150.4	6.42	8.3 , 10	

No change in this pair.

Procyon.

RA. $7^h 33^m 1^s$ Decl. $+5° 33'$.

1890.785 Carefully examined with various powers. Nothing nearer than the old companion. 36

β 579.

RA. $7^h 26^m 40^s$ Decl. $+33° 23'$.

1890.890	213.7	0.86	8 , 10	36
.898	214.3	0.83	7.7 , 9.5	36
.903	213.8	1.01	8 , 10.5	36
1890.90	213.9	0.90	7.9 , 10	

The only other measure of this is:

1878.24 219°1 0".84 β 1 n.

The principal star with two distant companions make $O\Sigma$ 173. The close star was discovered with the 6 inch.

Σ 1143.

RA. $7^h 41^m 41^s$ Decl. $+5° 42'$.

This is one of the missing pairs of Σ. As it could not be found by Struve himself, it is hardly worth while attempting to recover it. It is evidently in some other part of the sky. I examined all the stars in this vicinity with the 36 inch, and there is certainly no pair here answering Struve's description.

β 101. 9 Argus.

RA. $7^h 46^m 13^s$ Decl. $-13° 35'$.

1890.249	88.3	0.28	— , —	36
.252	84.8	0.29	— , —	36
.255	83.0	0.31	— , —	36
.269	82.4	0.34	— , —	36
1890.26	84.6	0.31	— , —	

1890.903	89.6	0.34	5.5 , 6.5	36
0.939	82.9	0.44	6 , 6	36
1.052	92.4	0.31	6 , 6.4	36
1890.96	88.3	0.36	— , —	

A binary in rapid motion but the measures are too few for the accurate determination of the period. The angular motion since 1875 is about 160°.

$O\Sigma$ 185.

RA. $7^h 51^m 7^s$ Decl. $+1° 27'$.

1890.903	8°1	0".20	6.8, 6.9	36
0.939	3.6	0.21	6.8, 7.2	36
1.052	6.2	0.24	7.0, 7.2	36
1890.96	6.0	0.22	6.9, 7.1	

There are very few measures of this pair. It has generally been noted as single, or doubtful. It may be in rapid motion, but the measures are insufficient to decide.

β 205.

RA. $8^h 27^m 54^s$ Decl. $-24° 12'$.

1890.274	82.2	0.65	7.5, 7.5	36
.282	81.6	0.75	—, —	36
1890.28	81.9	0.70	—, —	

Retrograde motion. The angles in the following measures are changed, when necessary, to the same side.

1874.19	130°±	0".7±	β
1878.53	100.3	0.63	$Cinc_3$ 3 n.
1882.21	96.6	0.5±	Sp 3 n.
1886.17	90.1	0.80	Wilson 2 n.

ε Hydrae.

RA. $8^h 40^m 25^s$ Decl. $+6° 52'$.

A and B.

1890.903	171.8	0.21	3.5, 5.5	36
.939	168.3	0.17	3.5, 6.0	36
1890.92	170.0	0.19	—, —	

The close pair, discovered by Schiaparelli in 1888, appears to be in rapid motion. These are the only measures:

1888.28	142°0	0".21	Shp. 6 n.
1888.98	154.4	0.26	β 2 n.

The measures indicate a motion of 16° per annum.

β 1071. θ Ursae Majoris.

RA. $9^h 25^m 50^s$ Decl. $+52° 11'$.

1890.356	78.1	5.11	—, 13.5	36
.375	80.2	4.62	—, —	36
.422	79.0	4.88	—, —	36
1890.38	79.1	4.87	—, —	

It is evident that the companion has the same proper motion as the large star. The measures of last year were:

1889.23 74°9 5".09 β 3 n.

As the bright star has a proper motion of 1".12 in the direction of 240°, the distance of the companion at the date of the above measures should be a little more than 6" if it had not the same movement. The stars are certainly physically connected.

A. C. 5. 8 Sextantis.

RA. $9^h 46^m 34^s$ Decl. $-7° 32'$.

1890.252	114°6	0".25	—, —	36
.269	113.9	0.36	—, —	36
.280	111.2	0.30	—, —	36
.301	116.8	0.39	—, —	36
1890.27	114.1	0.32	—, —	

An interesting binary, of which there are too few measures. The period will probably be not far from 60 years.

Regulus.

RA. $10^h 2^m 0^s$ Decl. $+12° 33'$.

B and C.

1890.255	86.0	3.01	—, —	36
.269	86.8	3.36	—, —	36
.282	84.2	2.78	—, —	36
1890.27	85.7	3.05	—, —	

There is no change in the double companion to Regulus since my first measures in 1878, and therefore both have the same proper motion as the large star, which is 0".267 in the direction of 274°5.

β 1077. α Ursae Majoris.

RA. $10^h 56^m 19^s$ Decl. $+62° 24'$.

1890.249	317.4	0.87	—, —	36
.252	322.9	0.83	—, —	36
.255	321.3	0.79	—, —	36
.269	318.6	1.00	—, —	36
1890.26	320.1	0.87	—, —	

The angle appears to be diminishing:

1889.19 326°1 0".91 β 4 n.

β 794.

RA. $11^h 47^m 13^s$ Decl. $+74° 26'$.

A and B.

1890.326	125.8	0.40	—, —	36
.337	129.1	0.59	—, —	36
.373	127.3	0.53	—, —	36
.375	125.4	0.48	—, —	36
1890.35	126.9	0.50	—, —	

AB and C.

1890.373	72.0	5.64	—, 14	36
.375	71.7	5.79	—, 13.5	36
1890.37	71.8	5.71	—, 13.7	

AB and D.

1890.373	78.7	26.79	—, 13	36
.375	78.5	26.67	—, 13	36
1890.37	78.6	26.73	—, 13	

The two distant companions are now seen and measured for the first time. There seems to be considerable change in the close pair.

1881.34 106°6 0".42 β 5 n.

β 1082. 78 Ursae Majoris.

RA. $12^h55^m35^s$ Decl. +57° 1'.

1890.252	77°4	1".35	— , —	36
.255	78.1	1.43	— , —	36
.280	75.1	1.61	— , —	36
1890.26	76.9	1.46	— , —	

Σ 1728. 42 Comae.

RA. $13^h4^m10^s$ Decl. +18° 10'.

1890.326	8.0	0.84	— , —	36
.331	10.2	0.54	— , —	12
.334	7.8	0.66	— , —	36
.337	11.4	0.78	— , —	36
1890.33	9.3	0.70	— , —	

Σ 1733.

RA. $13^h10^m27^s$ Decl. +17° 53'.

1890.331	126.0	4.50	8.5 , 10	12
.334	126.6	4.93	— , —	36
.337	125.8	4.97	— , —	36
1890.33	126.1	4.80	— , —	

No change since Struve.

β 800. Comae 201.

RA. $13^h10^m49^s$ Decl. +17° 40'.

1890.331	113.5	2.13	8 , 10.5	12
.334	116.0	1.96	7 , 10	36
.337	116.9	1.98	7.5 , 10	36
1890.33	115.5	2.02	7.5 , 10.2	

The following are all the measures:

1881.36 121°5 1".27 β 4 n.
1888.39 120.2 2.22 Comstock 3 n.

β 806.

RA. $14^h33^m27^s$ Decl. −25° 46'.

A and B. (New).

1890.375	96.9	0.70	7.5 , 10	36
.383	96.1	0.72	7 , 9	36
.406	95.9	0.59	7.5 , 9	36
1890.39	96.3	0.67	7.3 , 9.3	

C and D.

1890.375	343.2	1.34	8 , 9	36
.383	345.6	1.20	8.5 , 9.5	36
.406	345.9	1.07	8.5 , 9	36
1890.39	344.9	1.20	8.3 , 9.2	

A and C.

1890.375	67°2	71".28	— , —	36
.383	67.5	71.60	— , —	36
.406	67.3	71.57	— , —	36
1890.39	67.3	71.48	— , —	

A and a. (New).

1890.375	330.2	17.78	— , 13.5	36
.383	329 0	17.79	— , 13.5	36
1890.38	329.6	17.78	— , 13.5	

The double companion to the principal star was discovered at the Washburn Observatory in 1881. The 36 inch shows that the larger star is also double, so that it is now a fine quadruple group. The following are the only other measures:

1881.44 347°8 1".22 CD β 3 n.
1881.42 67.4 71.50 AC β 3 n.

β 31.

RA. $14^h46^m59^s$ Decl. +19° 13'.

A and B.

1890.340	190.8	1".33	8.3 , 9.5	36
.356	191.1	1.40	8.5 , 10	36
.364	188.9	1.46	8.3 , 9.7	36
1890.35	190.3	1.40	8.4 , 9.7	

A and C.

1890.340	162.1	9.13	— , 12	36
.356	162.2	8.95	— , 12.5	36
.364	163.8	9.00	— , 12	36
1890.35	162.7	9.03	— , 12.2	

This pretty triple star is near ξ Bootis. The close pair was discovered with the 6 inch. It is pretty certainly moving in angle.

1874.94 181°6 1".11 De 2 n.
1878.84 188.1 1.35 β 2 n.
1883.71 193.2 1.51 En 6 n.

The only other measures of C are:

1878.25 161°4 9".04 β 1 n.

Σ 3091.

RA. $15^h9^m43^s$ Decl. −4° 26'.

1890.375	46.7	0.33	— , —	36
.406	46.8	0.36	— , —	36
1890.39	46.8	0.35	— , —	

The measures of this pair are discordant, and perhaps on the whole do not show much change in the angle, but the distance for the last thirty years has been less than it was at the time of Σ, and probably about the same as it is now.

H. 1281.

RA. $15^h 50^m 17^s$ Decl. $-15° 41'$.

1890.364	229°.8	35".12	6.5, 12	36

Herschel called the companion 20th magnitude, and gave the angle and distance (estimated) 215°: 18". There are no other measures. I could not see the small star on two occasions in 1875 with the 6 inch. Herschel's 18 to 20 magnitudes as a rule represent stars which would be called about 12 in the scale used here.

β 1087. τ Coronae.

RA. $16^h 4^m 35^s$ Decl. $+36° 46'$.

1890.280	168.8	3.03	—, —	36
.334	168.5	3.32	—, 13.5	36
.340	167.5	3.02	—, —	36
1890.32	168.3	3.12	—, —	

As pointed out at the time of the discovery of this pair, if the companion is not moving through space with the large star, its distance should increase 0".34 per annum, that being the proper motion of τ in the direction of 348°. The measures show the stars to be relatively fixed, and therefore this motion is common to both.

1889.21 169°.1 3".11 β 3 n.

Σ 2032. σ Coronae.

RA. $16^h 10^m 12^s$ Decl. $+34° 10'$.

A and B.

1890.280	209.5	4.05	—, —	36
.337	207.1	3.99	—, —	36
.383	206.9	4.20	—, —	36
1890.33	207.8	4.08	—, —	

A and C.

1890.280	214.7	12.57	—, —	36
.337	211.4	12.29	—, —	36
.383	213.5	12.80	—, —	36
1890.33	213.2	12.55	—, —	

The change in the small star is due to the proper motion of AB.

β 625. ω Herculis.

RA. $16^h 19^m 52^s$ Decl. $+14° 19'$.

A and B.

1890.375	178.2	1.78	—, 12	36
.383	178.3	1.74	—, 11.5	36
1890.38	178.2	1.76	—, 11.7	

A and C.

1890.364	103.8	33.32	—, 12	36
.375	103.4	33.50	—, 12.5	36
.388	103.3	33.40	—, —	36
1890.37	103.5	33.41	—, 12.2	

These are the only other measures:

1879.21 176°.8 1".91 β 3 n.
1879.05 103.5 33.89 β 4 n.

β 815.

RA. $16^h 23^m 16^s$ Decl. $+43° 11'$.

1890.326	344°.0	7".93	—, —	36
.331	344.7	7.62	8.5, 10	36
.337	344.6	7.72	8.3, 9.5	36
1890.33	344.4	7.76	8.4, 9.7	

The change in this pair is due to proper motion, which measures show is about 0".17 per annum.

β 241.

RA. $16^h 48^m 24^s$ Decl. $-21° 22'$.

1890.452	157.3	0.68	7, 7	12
.458	162.2	0.83	7.5, 7.5	36
.463	160.5	0.75	—, —	36
1890.46	160.0	0.75	7.2, 7.2	

Change is doubtful.

β 1117. 24 Ophiuchi.

RA. $16^h 49^m 34^s$ Decl. $-22° 57'$.

1890.406	262.7	0.63	—, —	36
.452	265.2	0.45	—, —	36
.479	264.9	0.65	—, —	36
1890.45	264.3	0.58	—, —	

There seems to be no change since the measures of last year.

Σ 2120.

RA. $17^h 0^m 0^s$ Decl. $+28° 15'$.

1890.534 Large star not double. 36

The principal star of this pair was thought to be double by Perrotin in 1883.

β 1118. η Ophiuchi.

RA. $17^h 3^m 30^s$ Decl. $-15° 34'$.

1890.406	268.8	0.30	—, —	36
.447	271.6	0.41	—, —	36
.452	271.2	0.42	—, —	12
.496	272.9	0.40	—, —	36
1890.45	271.1	0.38	—, —	

The measures of last year were:

1889.39 274°.7 0".35 β 4 n.

α Herculis.

RA. $17^h 9^m 10^s$ Decl. $+14° 32'$.

A and D.

1890.422	39.1	84.91	—, 10.5	36
.447	38.9	84.60	—, 10.5	36
.458	39.1	84.87	—, 10.8	36
1890.44	39.0	84.79	—, 10.6	

Σ 2173.

RA. 17h24m14s Decl. −0° 58′.

1890.630	No third star.	36
.633	No third star.	36

In 1883 Wilson at Cincinnati measured a third star C, 10m, 291°.0 : 7″.±. As this has never been seen anywhere else, and is invisible now, it probably has no real existence.

β 1090. β Draconis.

RA. 17h27m43s Decl. +52° 23′.

1890.334	13°.1	4″.20	— , 14	36
.340	10.3	4.14	— , 13.5	36
.356	15.1	4.20	— , 14	36
1890.34	12.8	4.18	— , 13.8	

The measures of last year gave:

1889.26 13°.4 3″.97 β 4 n.

β 962. 26 Draconis.

RA. 17h33m44s Decl. +61° 58′.

1890.334	130.0	0.83	— , —	36
.383	134.5	0.71	— , —	36
.406	130.0	0.90	— , —	36
1890.37	131.5	0.81	— , —	

The distance of this interesting binary is slowly diminishing.

A.C. 7. μ Herculis.

RA. 17h41m47s Decl. +27° 48′.

B and C.

1890.356	9.3	0.63	— , —	36
.375	11.4	0.76	— , —	36
.383	9.2	0.61	— , —	36
.395	7.7	0.65	— , —	36
1890.38	9.4	0.66	— , —	

H. I. 41.

RA. 17h42m17s Decl. +72° 59′.

1890.452	341.3	1.55	8.5, 8.5	12
.455	341.1	1.24	8.3, 8.3	12
.463	342.1	1.28	8.2, 8.2	36
1890.46	341.5	1.36	8.3, 8.3	

Trifid nebula.

RA. 17h55m6s Decl. −23° 1′.

A and B.

1890.537	23.0	6.07	— , 11	36
.542	23.1	5.84	8 , 10.8	12
.548	21.5	6.27	— , 10	12
1890.54	22.5	6.06	8 , 10.6	

A and C.

1890.537	210°.6	10″.75	7.5 , —	36
.542	212.6	10.83	— , 9	12
.548	213.7	10.54	8 , 8.7	12
1890.54	212.3	10.71	7.7, 8.8	

C and D.

1890.537	281.2	2.17	8.5, 10.5	36
.556	282.3	2.17	9 , 10.5	36
1890.55	281.7	2.17	8.7, 10.5	

C and E.

1890.537	191.1	6.24	— , 13.5	36
.553	191.8	6.09	— , 11.8	36
.556	189.6	6.25	— , 12	36
1890.55	190.8	6.19	— , 12.4	

A and F.

1890.537	106.0	22.22	— , 14	36
.553	106.5	21.96	— , 13.5	36
.556	106.7	21.99	— , 14	36
1890.55	106.4	22.06	— , 13.8	

C and G.

1890.537	212.2	29.69	— , 13	36
.553	211.6	29.54	— , 13	36
.556	211.9	29.46	— , 13.5	36
1890.55	211.9	29.56	— , 13.2	

Like the stars in the Orion nebula, these stars have remained relatively fixed, and are as uninteresting as the famous trapezium, aside from their accidental surroundings. The large telescope does not show any additional stars in the group near enough to be worth measuring.

β 1125. 68 Ophiuchi.

RA. 17h55m40s Decl. +1° 19′.

1890.447	18.8	0.93	5 , 8.5	36
.463	20.4	0.94	— , —	36
.496	19.8	0.87	— , 9	36
1890.47	19.7	0.91	— , —	

No certain change since last year.

A.C. 15. 99 Herculis.

RA. 18h2m28s Decl. +30° 23′.

1890.406	285.2	0.57	5.5, 11	36
.463	285.0	0.61	— , —	36
.496	285.0	0.51	— , —	36
1890.45	285.1	0.56	— , —	

Mr. Gore has recently computed an orbit for this interesting binary, using these measures, and finds a period of 53.55 years.

β 641.

RA. $18^h16^m43^s$ Decl. $+21°27'$.

1890.447	346°.4	1".03	7 , 9	36
.455	341.2	1.15	7.5, 9	12
.458	350.2	0.85	7.5, 9	36
1890.45	345.9	1.01	7.3, 9	

There seems to be slow motion in the angle.

1878.68	356°.4	1".07	De 1 n.
1880.12	349.2	1.00	β 5 n.

Σ 2384.

RA. $18^h38^m33^s$ Decl. $+67°0'$.

1890.534	306.3	0.42	8 , 8.1	36
.573	305.6	0.41	— , —	36
.575	308.4	0.39	8 , 8.2	36
1890.56	306.8	0.41	— , —	

Probably a binary, but there has been little change in the angle.

$O\Sigma$ 365.

RA. $18^h52^m20^s$ Decl. $+44°4'$.

1890.575 Certainly not double. First rate 36 night.

This is the principal star of Σ 3130. I have examined this star many times with different instruments, and never saw the least suspicion of duplicity. On the whole, the weight of the evidence is against its really being double.

ζ Sagittarii.

RA. $18^h55^m0^s$ Decl. $-30°3'$.

1890.452	250.4	0.65	— , —	12
.499	253.6	0.90	— , —	36
.523	249.3	0.74	— , —	12
1890.49	251.1	0.76	— , —	

A binary of short period. Gore, 18.69 years.

Σ 2438.

RA. $18^h55^m29^s$ Decl. $+58°4'$.

1890.499	47.0	0.25	6.5, 6.7	36
.537	41.3	0.23	— , —	36
.573	45.6	0.27	— , —	36
1890.54	44.6	0.25	— , —	

This binary is now opening out, but the motion is slow. The measures here, taken in connection with those of Σ and $O\Sigma$, indicate a period of about 120 years. Herschel's angle in 1783 seems to be some 20° too small to fall in with the later observations.

β 973.

RA. $18^h55^m59^s$ Decl. $+8°34'$.

A and B.

1890.594	350.1	1.49	9 , 11.5	36
.610	350.0	1.72	9 , 12	36
.630	350.0	1.59	9 , 10.8	36
1890.61	350.0	1.60	9 , 11.6	

C and D. (Howe).

1890.594	259°.3	3".27	11 , 11.1	36
.610	261.3	3.23	11 , 11.3	36
.630	259.8	3.23	11 , 11.2	36
1890.61	260.1	3.24	11 , 11.2	

A and C.

1890.594	18.6	11.03	— , —	36
.610	21.2	11.02	— , —	36
.630	19.5	11.12	— , —	36
1890.61	19.8	11.06	— , —	

A and D. (Σ 2435).

1890.594	12.6	10.04	— , —	36
.610	11.8	10.16	— , —	36
1890.60	12.2	10.10	— , —	

There has been no change in the Struve star, and probably none in the close pairs.

1880.13	350°.7	1".43	β 5 n.
1880.13	262.7	2.90	β 5 n.

H. N. 126.

RA. $18^h57^m10^s$ Decl. $-21°43'$.

1890.452	353.8	0.55	8 , 8.2	12
.496	355.1	0.62	— , —	36
.499	350 6	0.58	8 , 8	36
1890.48	353.2	0.58	8 , 8.1	

This pair seems to be moving rapidly. In 1873, finding it had never been observed apparently since the time of Herschel, and as his description of it was limited to giving it as belonging to his class I, I looked it up, and fortunately estimated the angle and distance. Subsequently it was measured at Cincinnati, and these are all the observations down to this time. The distance is certainly diminishing, and probably the motion in angle is rapid.

1873	40°±	1"±	β
1879.53	22.4	0.83	Cin. 2 n.
1890.48	353.2	0.58	β 3 n.

β 975.

RA. $19^h10^m4^s$ Decl. $+34°21'$.

B and C.

1890.613	222.0	0.84	9.0, 9.7	36
.633	219.8	0.74	10 , 11.3	36
.649	225.0	0.91	9 , 9.5	36
1890.63	222.3	0.83	9.3, 10.2	

A and B. ($O\Sigma$ 367).

1890.633	227.3	33.34	7.5, —	36

No change in the wide pair, and probably none in the other.

1880.59	221°.8	0".77	β 3 n.

β 248. 2 Vulpeculae.

RA. $19^h12^m39^s$ Decl. $+22°49'$.

1890.613	126°9	1".71	— , —	36
.630	124.6	1.97	— , —	36
.649	124.8	1.89	— , —	36
1890.63	125.4	1.86	— , —	

Some of the measures of this pair are not very accordant, but on the whole there is little evidence of change.

1876.11 125°0 1".86 De 6 n.

H. A. Howe.

RA. $19^h14^m37^s$ Decl. $+2°43'$.

1890.556	333.2	0.35	8.5, 8.5	36
.564	335.8	0.40	8.0, 8.2	36
.573	333.0	0.43	8 , 8.2	36
1890.56	334.0	0.39	8.2, 8.3	

No evidence of change since its discovery by Howe at Cincinnati.

1879.52 336°0 0".4 ± Cinc$_5$ 3 n.

β 141.

RA. $19^h16^m50^s$ Decl. $+22°17'$.

1890.613	81.5	0.81	— , —	36
.649	79.0	0.84	— , —	36
.652	77.0	0.75	7.5, 8.5	36
1890.64	79.2	0.80	— , —	

This is the principal star of the wide pair, H. 2867. The large telescope also shows that H.'s companion, 26" from the larger star, is a 4" or 5" pair. Thus far there is no evidence of change in the pair measured above.

De. 21.

RA. $19^h25^m1^s$ Decl. $-2°22'$.

A and B.

1890.675	67.7	1.03	7.5, 9	36
.706	67.0	1.05	7 , 9	36
.709	65.9	1.03	7.5, 9	36
1890.70	66.9	1.04	7.3, 9	

A and C. (Σ 2535).

1890.675	298.0	26.15	— , 9	36
.706	297.9	26.17	— , 9	36
.709	298.1	26.30	— , 9.5	36
1890.70	298.0	26.21	— , 9.2	

The close pair is the principal star of Σ 2535, discovered by De. in 1865. There is very little evidence of change thus far:

1865.76 70°0 1".22 De 2 n.

I observed this star principally for the purpose of finding whether the third star near A, suspected by De., had any real existence. I have never been able to see it with other large telescopes, and as the 36 inch fails to show it, it will not be necessary to make any further search.

A. G. C. 10.

RA. $19^h39^m15^s$ Decl. $+10°29'$.

A and B.

1890.594	143°6	0".24	8.5, 8.6	36
.610	145.8	0.25	8 , 8	36
.630	146.0	0.22	8.3, 8.5	36
1890.61	145.1	0.24	8.3, 8.4	

AB and C. (Σ 2570).

1890.594	275.9	4.33	— , 9.7	36
.610	278.0	4.38	— , 9.5	36
.630	279.0	4.20	— , 9	36
1890.61	277.6	4.30	— , 9.4	

The close pair was discovered by Mr. Clark in 1875 with the 12 inch which is now at the Lick Observatory. There is no change in the Σ companion. The following are all the measures of AB:

1878.35 145°5 0".29 β 3 n.
1880.22 147.6 0.29 β 3 n.

A. G. C. 11. ζ Sagittae.

RA. $19^h43^m39^s$ Decl. $+18°51'$.

A and B.

1890.496	179.7	0.13	— , —	36
.537	175.7	0.12	— , —	36
.573	183.8	0.10	— , —	36
1890.53	179.7	0.12	— , —	

This pair was also discovered with the 12 inch, now belonging to the Lick Observatory, by Mr. Clark in 1875. It has now become a very close and difficult object. The change has been largely in distance. Special attention was given in these measures to the proper quadrant for the smaller component. The angle found last year should be increased 180°. This pair will have a moderately short period, but will always be a difficult object, as the maximum distance cannot much exceed 0".3.

Ho. 276.

RA. $19^h53^m16^s$ Decl. $-10°16'$.

1890.655 Apparently single. First class 12 night.
.709 Nothing seen, but not the best 36 seeing.

Described by Ho. as elongated in the direction of 172°9 (1887.75). This star has a large proper motion of 0".507 in 221°8.

$O\Sigma$ 392.

RA. $19^h53^m54^s$ Decl. $+41°56'$.

A and B.

1890.675	305.3	0.28	7 , 8.5	36
.687	306.8	0.32	8 , 9	36
.689	306.4	0.28	7 , 8	36
1890.68	306.2	0.29	7.3, 8.5	

A and C. (Σ 2607).

1890.675	289°.9	3".19	—, 9	36
.687	293.0	3.19	—, 9	36
.689	291.6	3.11	—, 8.5	36
1890.68	291.5	3.16	—, —	

There is no change in Σ 2607 since 1831. There may be a little retrograde motion in the close pair, but it is only a few degrees at most since the first measures in 1844.

Σ 2652.

RA. $20^h 7^m 3^s$ Decl. $+61° 43'$.

1890.675	263.6	0.31	7.5, 7.8	36
.687	263.3	0.31	7.5, 7.6	36
.689	265.0	0.30	7.5, 7.6	36
1890.68	264.0	0.31	7.5, 7.7	

Certainly binary, but the motion is very slow. The angle has diminished only 19° since the measures of Σ in 1836, and the distance has remained nearly constant.

β 668. B. A. C. 7080.

RA. $20^h 25^m 49^s$ Decl. $-10° 16'$.

1890.556	24.8	4.80	7, 11	36
.573	24.1	4.74	6.7, 11	36
.575	26.0	4.87	6.7, 11.5	36
1890.57	25.0	4.80	6.8, 11.2	

The large star has a proper motion of 0".286 in the direction of 66°.7. As this is common to both stars, they undoubtedly form a physical system. The following are all the measures:

1878.63	29°.0	4".64	β 3 n.
1881.67	26.1	4.99	β 4 n.

β 151. β Delphini.

RA. $20^h 31^m 55^s$ Decl. $+14° 11'$.

A and B.

1890.447	322.7	0.50	—, —	36
.496	323.6	0.37	—, —	36
.499	324.4	0.57	—, —	36
.526	326.1	0.36	—, —	36
1890.49	324.2	0.45	—, —	

AB and C.

1890.447	117.2	26.78	—, —	36
.458	117.5	26.85	—, —	36
.479	117.2	27.05	—, —	36
1890.46	117.3	26.89	—, —	

The distance of this rapid binary is increasing, and it will be comparatively easy to measure for a few years. The last computed orbit of 16 years is certainly too short. It will probably be about 28 years.

β 677. T Cygni.

RA. $20^h 42^m 23^s$ Decl. $+33° 56'$.

A and B.

1890.499	121°.2	9".93	5, 12.5	36
.518	121.0	9.64	5.5, 12	36
.534	120.6	10.15	6.2, 12	36
1890.52	120.9	9.91	—, 12.2	

A and C.

1890.499	194.5	12.40	—, 13.5	36
.518	193.9	12.51	—, 13	36
.534	194.9	12.14	—, 13.5	36
1890.52	194.4	12.35	—, 13.3	

The principal star is T Cygni of the variable star catalogues. The second companion, C, is now observed for the first time. My original measures of B require a correction of 180° in the angle.

1878.41	121°.3	9".66	β 1 n.

Secchi.

RA. $20^h 58^m 43^s$ Decl. $+3° 3'$.

B and C.

1890.675	152.1	1.16	9.5, 9.5	36
.678	148.8	1.17	9, 9	36
.681	151.7	1.12	9, 9	36
1890.68	150.9	1.15	9.2, 9.2	

A and B. (Σ 2749).

1890.675	155.6	3.11	7.5, —	36
.678	152.3	2.96	7.3, —	36
.681	155.6	3.01	7.7, —	36
1890.68	154.5	3.03	7.5, —	

The close pair was discovered by Secchi in 1856. There has been some change.

1856.60	127°.0	0".6	Se
1863.88	141.7	0.8	De 1 n.
1877.79	148.9	1.13	β 1 n.

The Struve star has remained fixed.

β 368. Aquarii 45.

RA. $21^h 1^m 1^s$ Decl. $-8° 43'$.

A and B.

1890.630	89.2	0.64	7.0, 7.5	36
.649	88.3	0.56	7.0, 8.0	36
.652	88.6	0.53	6.7, 7.8	36
1890.64	88.7	0.58	6.9, 7.8	

C and D. (New).

1890.630	317.7	6.09	14, 14.5	36
.673	318.1	6.20	14, 15	36
1890.65	317.9	6.15	14, 14.7	

AB and C.

1890.630	27°.5	12".07	— , —	36
.673	27.0	11.98	— , —	36
1890.65	27.2	12.02	— , —	

The close pair was discovered with the 6 inch in 1873. The large telescope shows a double companion not seen before. Slow retrograde motion in AB.

1876.78 97°.1 0".55 De 5 n.
1881.63 90.4 0.63 β 3 n.

Σ 2758. 61 Cygni.

RA. 21h 1m 14s Decl. +38° 8'.

1890.862	121.0	21.38	— , —	12
.867	121.9	21.17	— , —	12
.873	122.3	21.01	— , —	12
.876	122.3	21.02	— , —	12
1890.87	121.9	21.15	— , —	

An examination of the measures of the last sixty years shows, assuming the proper motion of A, 5".196 in the direction of 51°.5, to be correct, that the proper motion of B is 5".113 in the direction of 53°.5. The measures show conclusively that this motion is uniform and rectilinear. (See Sidereal Messenger, January, 1891).

Ho. 283.

RA. 21h 6m 14s Decl. +35° 49'.

1890.649 Cannot see large star double. 36
Good night.
.652 No close star seen. 36

Described by Hough, 178° ± : 0".8 ± : 6.8, 12. As there is a distant companion, there is no doubt of the identity of the star examined.

A. G. C. 13. τ Cygni.

RA. 21h 10m 0s Decl. +37° 32'.

A and B.

1890.526	20.8	0.45	— , —	36
.537	21.3	0.66	— , —	36
.556	20.1	0.52	— , —	36
1890.54	20.5	0.54	— , —	

A and C.

1890.496	245.4	19.65	— , —	36
.537	245.2	19.88	— , —	36
.556	245.5	19.80	— , —	36
1890.53	245.4	19.78	— , —	

One of the most interesting of the binary stars, and now a difficult pair to measure.

14 Aquarii.

RA. 21h 9m 52s Decl. −9° 43'.

1890.777 Certainly not double. Fine seeing. 36

Discovered by Dembowski in 1875. He seems to have had some doubt as to whether the elongation measured was real. I have never been able to see it with any instrument, and hardly think it can be double.

β 164.

RA. 21h 19m 13s Decl. +8° 52'.

A and B.

1890.675	241°.3	0".50	7 , 7.3	36
.681	239.5	0.51	7.8, 8	36
.709	239.9	0.49	8 , 8.1	36
1890.69	240.2	0.50	7.6, 7.8	

A and C. (Σ 2793).

1890.675	241.4	27.00	— , 8.5	36
.681	241.4	27.00	— , 9	36
.709	241.6	26.97	— , 8.7	36
1890.69	241.5	26.99	— , 8.7	

The close pair discovered with the 6 inch, 1873. No sensible change in the Σ companion, and very little, if any, in the other since it has been observed.

1875.46 241°.6 0".57 De 4 n.

β 684.

RA. 21h 23m 53s Decl. −5° 57'.

1890.675	128.1	1.20	8.7, 9	36
.678	125.0	1.13	8.5, 8.7	36
.681	127.1	1.03	8.8, 9	36
1890.68	126.7	1.12	8.7, 8.9	

Perhaps some angular motion:

1878.62 133°.9 1".11 β 1 n.

β 72.

RA. 21h 23m 43s Decl. −5° 55'.

1890.675	40.3	1.90	8.3, 8.7	36
.678	44.5	1.87	8.3, 9	36
.681	41.8	1.76	8.3, 9	36
1890.68	42.2	1.84	8.3, 8.9	

These two pairs are in a low power field with β Aquarii.

1878.17 43°.1 1".90 β 2 n.

β 989. $\varkappa$ Pegasi.

RA. 21h 39m 12s Decl. +25° 6'.

1890.526	191.2	0.08	— , —	36
.573	176.5	0.10	— , —	36
.575	202.8	0.10	— , —	36
.610	178.0	0.10	— , —	36
1890.57	187.1	0.10	— , —	

The measures seem to indicate that this will have the shortest period of any double-star known, about eleven

years, so that near the end of the present year it will be in the same position as at the time of discovery. (For a history of this pair, and a discussion of the measures to this time, see a paper by the present writer in Monthly Notices for March, 1891.

H. A. Howe.

RA. $21^h\,40^m57^s$ Decl. $-13°\,42'$.

A and B.

1890.630	104°.6	0".70	8 , 9	36
.644	105.1	0.59	8 , 9.3	36
.652	104.4	0.64	8 , 9	36
1890.64	104.7	0.64	8 , 9.1	

A and C. (Σ 2826).

1890.630	82.6	4.27	— , 8.5	36
.644	81.5	4.28	— , 8.7	36
.652	81.6	4.29	— , 8.7	36
1890.64	81.9	4.28	— , 8.6	

Probably unchanged:

1879.64 285°.0 0".8 ± Cinc$_3$ 1 n.

The Struve star is fixed.

β 275.

RA. $21^h\,53^m38^s$ Decl. $+60°\,43'$.

1890.675	2.6	0.44	7.7 , 8	36
.687	6.7	0.38	7.5 , 7.6	36
.689	2.1	0.34	7.5 , 8	36
1890.68	3.8	0.39	7.6 , 7.8	

The only other measures are:

1876.04 2°.7 0".28 De 4 n.

Leavenworth.

RA. $22^h\,4^m8^s$ Decl. $-11°\,40'$.

1890.802	164.6	0.93	9.2 , 9.3	36
.824	161.2	0.80	8.7 , 8.9	36
.840	166.3	0.82	9.0 , 9.1	36
1890.82	164.0	0.85	9.0 , 9.0	

Discovered by Leavenworth at the Mc Cormick Observatory. This star is SD. $-11°.5771$.

1886.79 164°.6 0".93 L 2 n.

Ho. 290.

RA. $22^h\,6^m44^s$ Decl. $+57°\,21'$.

A and B.

1890.649	No suspicion of Ho.'s star.	36
.655	Nothing seen. Magnificent seeing.	12
.675	No trace of any close star.	36

As a wide pair this star is β 436. In 1889 Hough measured a star 11^m at a distance of 0".53 from A in the direction of 208°.5. There is no trace of any such star now.

Σ 2881.

RA. $22^h\,9^m6^s$ Decl. $+28°\,59'$.

1890.499	100°.4	1".58	8 , 8.5	36
.518	99.7	1.64	8 , 8.3	36
.523	99.5	1.63	8.3 , 8.5	36
1890.51	99.9	1.62	8.1 , 8.4	

The change in this pair is very slow. The distance is about the same as it was in 1830, but the angle is 11° less.

Σ 2912. 37 Pegasi.

RA. $22^h\,23^m54^s$ Decl. $+3°\,49'$.

1890.526	343.8	0".1 ±	36
.610	350.1	less than 0.1	36
1890.56	347.0		

This star is opening out now, with the small star on the opposite side from that on which it has always been seen heretofore. The plane of the apparent orbit must be nearly in the line of sight, as the change in position angle is small. I found the angle 130°.0 in 1878, and En 131°.4 in 1885. It is possible that the angle given above is in the wrong quadrant, but I think not, as I found it apparently single with the 36 inch last year.

β 1147. 2 Andromedae.

RA. $22^h\,57^m5^s$ Decl. $+42°\,7'$.

1890.575	311.0	0.27	5.5 , 10	36
.610	311.1	0.30	— , —	36
.675	316.9	0.25	5 , 8	36
1890.62	313.0	0.27	— , —	

The measures at the time of discovery were:

1889.54 317°.8 0".28 β 3 n.

$O\Sigma$ 487.

RA. $22^h\,59^m10^s$ Decl. $+80°\,8'$.

1890.673	206.8	0.22	7 , 9	36
.687	211.5	0.12	6.8 , 8.5	36
.689	206.7	0.25	7 , 8.5	36
1890.68	208.3	0.20	6.9 , 8.7	

This close pair has never before been measured. It was seen elongated by $O\Sigma$ from 1844 to 1858, the approximate angle being about 49°. (See A. N. 3017).

β 180.

RA. $23^h\,2^m9^s$ Decl. $+60°\,11'$.

A and B.

1890.633	175.2	0.63	8 , 9.2	36
.652	175.2	0.62	8 , 9.5	36
.673	175.3	0.62	8 , 9.0	36
1890.65	175.2	0.62	8 , 9.2	

A and C.

1890.633	106°.7	34".25	—, 9.3	36
.652	106.5	34.45	—, 9.5	36
.673	106.5	34.59	—, 9.5	36
1890.65	106.6	34.43	—, 9.4	

The only prior measures are:

1875.08	176°.8	0".57	De 4 n.
1875.54	106.3	34.30	De 2 n.

β 385.

RA. $23^h 4^m 31^s$ Decl. +31° 50'.

A and B.

1890.673	128.9	0.50	7.7, 8.5	36
.687	130.2	0.46	7.5, 7.8	36
.689	132.0	0.43	7.5, 8	36
1890.68	130.4	0.46	7.6, 8.1	

AB and C. (H. 5532).

1890.673	77.2	58.09	—, 9	36
.687	77.3	57.83	—, 8.3	36
.689	77.4	58.16	—, 9	36
1890.68	77.3	58.03	—, 8.8	

H. has no measures of the distant star.

1876.40	135°.8	0".42	De 7 n.
1885.46	143.2	0.41	En 4 n.
1876.72	77.1	58.05	De 2 n.

β 715. Aquarii 290.

RA. $23^h 8^m 25^s$ Decl. —11° 20'.

1890.630	255.8	3.56	6.8, 11.7	36
.652	257.8	3.58	6.5, 12	36
.660	257.2	3.35	6.5, 11.5	36
1890.65	256.9	3.50	6.6, 11.7	

The Cincinnati observers in 1877 measured the large star as a close pair, 1°.5 : 0".32. This was carefully looked for with the 36 inch in making the above measures, and there was no trace of any elongation at any time. There seems to be no change in the measured star:

1878.29	256°.0	3".35	β 4 n.

β 992.

RA. $23^h 10^m 48^s$ Decl. +63° 29'.

1890.630	162.0	0.31	8.3, 8.3	36
.633	163.2	0.37	8.3, 8.3	36
.652	159.2	0.34	8.0, 8.2	36
1890.64	161.5	0.34	8.2, 8.3	

The only other measures are:

1880.59	170°.5	0".41	β 5 n.

Ho. 199. 95 Aquarii.

RA. $23^h 12^m 43^s$ Decl. —10° 16'.

1890.610	216°.9	1".15	.5, 13	36
.630	220.3	1.13	—, 11.5	36
.633	—	1.16	—, 11	36
1890.62	218.6	1.15	—, 11.8	

During the evening of the last measure, the micrometer was disturbed, and this with other angles were lost.

β 278.

RA. $23^h 15^m 20^s$ Decl. +61° 33'.

1890.630	174.0	12.68	6.5, 11.5	36
.633	173.7	12.62	6.5, 11.5	36
.652	173.9	12.69	6.8, 12.5	36
1890.64	173.9	12.66	6.6, 11.8	

No other measures.

Ho. 300. 66 Pegasi.

RA. $23^h 17^m 1^s$ Decl. +11° 39'.

1890.652	Not the least trace of duplicity with 1900.			36

According to Ho. this is an equal pair, elongated (1889.85) in the direction of 312°.1. I could see nothing to indicate this with any power on the 36 inch. The conditions were favorable.

β 774.

RA. $23^h 25^m 18^s$ Decl. +63° 40'.

1890.630	5.9	0.46	8.5, 8.8	36
.633	0.6	0.59	8.5, 8.8	36
.652	5.7	0.52	8.0, 8.2	36
1890.64	4.1	0.52	8.3, 8.6	

Discovered with the 6 inch on Mt. Hamilton in 1879. The only other measures are:

1880.58	6°.7	0".51	β 3 n.

β 720. 78 Pegasi.

RA. $23^h 28^m 0^s$ Decl. +30° 40'.

1890.526	147.8	0.32	—, —	36
.556	146.9	0.39	—, —	36
.564	150.1	0.41	—, —	36
1890.55	148.3	0.37	—, —	

This is certainly a binary system. The change is principally in angle, which amounts to about 20° since it was discovered in 1878.

β 733. 85 Pegasi.

RA. $23^h 55^m 52^s$ Decl. $+26° 27'$.

A and B.

1890.526	138°.1	0".73	— , —	36
.556	139.6	0.82	— , —	36
.564	137.2	0.80	— , —	36
.573	141.1	0.78	— , —	36
1890.55	139.0	0.78	— , —	

A and C.

1890.496	357°.0	23".53	— , —	36
.499	356.7	23.56	— , —	36
.564	356.5	23.68	— , —	36
1890.52	356.7	23.59	— , —	

The measures agree well with the computed place from Schaeberle's orbit. The period of 22.3 years cannot be far wrong.

New Nebulae.

In the course of my double-star work a faint nebula is occasionally found, usually in the field with some bright star under examination. These are almost invariably new, or wanting in Dreyer's General Catalogue, and when near enough to a prominent star to be measured directly with the micrometer, I have saved them as far as it could be done without interfering with the regular work. With the high powers and small fields of the eye-pieces used in observing double stars, a nebula would rarely be seen except when near a star. The lowest power used has a field of only 5', much too small for very faint, diffused objects. The following nebulae have been measured with the 36 inch. The places given are those of the stars from which the nebulae are measured, the star in each instance being the primary.

ρ Piscium and nebula.

RA. $1^h 19^m 47^s$ Decl. $+18° 33'$.

1890.564	62°.7	158".12	— , —	36
.610	62.6	160.36	— , —	36
.633	—	159.38	— , —	36
1890.60	62.6	159.29	— , —	

94 Piscium and nebula.

RA. $1^h 20^m 13^s$ Decl. $+18° 37'$.

1890.564	117.4	211.63	— , —	36
.610	118.3	211.70	— , —	36
1890.59	117.8	211.66	— , —	

A little brighter than the preceding.

Star and nebula.

RA. $2^h 53^m 48^s$ Decl. $+37° 17' 52''$.

1890.698	114.6	95.33	9.5, —	36
.709	114.8	95.48	10 , —	36
1890.70	114.7	95.40	9.7, —	

The comparison star is not in the DM. The place given was determined by Mr. Barnard with the micrometer from W_2 $2^h.1203$. There is a faint star about 12" from the nebula in the direction of 248°.

Star and nebula. (South)

RA. $3^h 7^m 26^s$ Decl. $+37° 25' 18''$.

1890.698	221°.5	49".16	— , —	36
.709	220.0	49.64	11.5, —	36
1890.70	220.7	49.40	11.5, —	

Star and nebula. (North).

1890.698	304.2	76.29	— , —	36
.709	303.6	76.06	— , —	36
1890.70	303.9	76.17	— , —	

Both nebulae are measured from the same star. Its place as given above was obtained by Mr. Barnard from BB.VI $+37°.753$, which is $3^m 21^s.7$ f, and 4' 24".5 n.

DM. $+2°.684$ and nebula.

RA. $4^h 12^m 48^s$ Decl. $+2° 48'$.

1890.709	224.8	210.39	9.5, —	36
.760	224.9	211.22	9.5, —	36
.785	224.4	209.73	— , —	36
1890.75	224.7	210.45	— , —	

Very faint.

Dreyer 1550 and nebula.

RA. $4^h 13^m 23^s$ Decl. $+2° 7'$.

1890.760	163.5	187.88	— , —	36
.785	162.9	189.43	— , —	36
1890.77	163.2	188.66	— , —	

This is in the field with one of d'Arrest's nebulae, with which the new one is compared. That found by d'Arrest is at least six or eight times brighter than the other. There is a faint star, about 13^m, between the two.

Lal. 29710 and nebula.

RA. $16^h 11^m 29^s$ Decl. $+36° 52'$.

1890.383	200.3	105.55	— , —	36
.395	200.1	104.95	— , —	36
.422	200.1	104.79	— , —	36
1890.40	200.1	105.10	— , —	

The star is seventh magnitude.

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Double Star Observations

made at the Lick Observatory in May, June and July 1889.

By *S. W. Burnham.*

The following double star observations have been made since the preparation of the last preceding list (A. N. 2929–30), and principally in the months of May, June and July of the present year. Since that time the large telescope has been used the greater part of the time for other work. During the period mentioned, 62 new pairs have been discovered and measured; and measures made of 98 of the more interesting and difficult pairs from former catalogues; altogether comprising 628 separate measures. This work has been done with the 36 inch equatorial with the exception of the measures of a few southern stars which could be more conveniently made with the smaller telescope.

The present catalogue of new stars is the sixteenth in order of publication. These lists have appeared as follows:

First Catalogue	Nos. 1 to 81	Monthl. Not.	March 1873	Ninth Catalogue	Nos. 453 to 482	Monthl. Not.	Dec. 1877
Second »	» 82 » 106	»	May 1873	Tenth »	» 483 » 733	Memoirs R.A.S.	Vol. 44
Third »	» 107 » 182	»	Dec. 1873	Eleventh »	» 734 » 775	Lick Obs. Publ.	I
Fourth »	» 183 » 229	»	June 1874	Twelfth »	» 776 » 863	Washb. Obs. Publ.	I
Fifth »	» 230 » 300	»	Nov. 1874	Thirteenth »	» 864 » 1025	Memoirs R.A.S.	Vol. 47
Sixth »	» 301 » 390	Astr. Nachr.	No. 2062	Fourteenth »	» 1026 » 1038	Astr. Nachr.	No. 2875
Seventh »	» 391 » 436	»	» 2103	Fifteenth »	» 1039 » 1092	»	» 2929–30
Eighth »	» 437 » 452	Amer. Journ. of Sc.	July 1877	Sixteenth »	» 1093 » 1154	The present Catalogue.	

The places of the stars are given, as heretofore, for 1880. The instrument used in each observation is given in the last column.

New Double Stars. (Sixteenth Catalogue.)

β 1093. Lal. 375.
RA. $0^h 14^m 43^s$ Decl. $+10° 19'$.

1889.630	55°8	0".37	7 , 8	36
.633	57.8	0.42	7.5, 8	36
.687	49.2	0.39	7.5, 8.5	36
1889.65	54.3	0.39	7.3, 8.2	

The following of three bright stars.

β 1094. Lal. 655.
RA. $0^h 23^m 35^s$ Decl. $+59° 19'$.

1889.526	242.8	0.60	5 , 9	36
.534	244.3	0.81	6 , 9.5	36
.537	246.6	0.70	6 , 10	36
1889.53	244.6	0.70	5.7, 9.5	

β 1095. 28 Andromedae.
RA. $0^h 23^m 47^s$ Decl. $+29° 5'$.

1889.509	0.4	2.37	5.5, 13	36
.512	0.1	2.33	5.5, 14	36
.515	359.7	2.55	5.5, 13	36
1889.51	0.1	2.42	5.5, 13.3	

β 1096. AOe. 534.
RA. $0^h 29^m 46^s$ Decl. $+57° 51'$.

A and B.

1889.594	265°2	0".19	9.5, 9.6	36
.671	267.9	—	—, —	36
.673	269.9	0.25	9.5, 9.5	36

AB and C.

1889.594	61.7	33.29	—, 8.6	36
.597	61.6	33.49	—, 9	36
.608	62.0	33.36	—, 9	36
1889.60	61.8	33.38	—, 8.9	

β 1097. Radcl. 159.
RA. $0^h 30^m 30^s$ Decl. $+57° 21'$.

1889.594	72.1	0.56	8 , 8	36
.597	69.9	0.71	8.5, 8.5	36
.608	71.5	0.52	8.2, 8.2	36
.611	72.8	0.50	8.5, 8.5	36
1889.60	71.6	0.57	8.4, 8.4	

The magnitude in Radcl. is 7.4, and in DM. 7.0.

β 1098. v^1 Cassiopeiae.

RA. $0^h47^m53^s$ Decl. $+58°19'$.

1889.594	75°4	12″77	5 , 13.5	36
.608	74.9	12.61	6 , 13.5	36
.611	75.3	12.99	6 , 13.5	36
1889.60	75.2	12.79	6 , 13.5	

β 1099. B.A.C. 255.

RA. $0^h49^m33^s$ Decl. $+59°43'$.

1889.534	270.0	0.13	6 , 6.5	36
.589	276.0	0.16	6 , 7	36
.594	264.5	0.16	6.3 , 7	36
1889.57	270.2	0.15	6.1 , 6.8	

This very close and difficult pair is 21′ s. of γ Cassiopeiae. It is Groombridge 184.

β 1100. Lal. 2155.

RA. $1^h7^m5^s$ Decl. $+60°18'$.

1889.526	45.3	0.51	7.5 , 7.5	36
.534	45.4	0.47	7.3 , 7.3	36
.553	40.2	0.45	7.3 , 7.3	36
1889.54	43.6	0.48	7.4 , 7.4	

β 1101. ψ Cassiopeiae.

RA. $1^h17^m27^s$ Decl. $+67°30'$.

A and B.

1889.515	41.3	3.40	4.5 , 13.5	36
.523	40.9	3.07	4.5 , 13.5	36
.526	41.9	3.07	— , 13	36
.534	40.6	3.24	— , 14	36
1889.52	41.2	3.19	— , 13.5	

A and C (= Σ 117).

1889.515	107.3	28.21	— , —	36
.523	107.9	27.90	— , —	36
.526	107.2	27.84	— , —	36
.534	107.4	28.10	— , —	36
1889.52	107.4	28.01	— , —	

C and D (= Σ 117).

1889.515	255.6	2.83	9.5 , 9.7	36
.523	255.0	2.87	9.5 , 9.7	36
.526	254.5	2.87	9.8 , 10	36
.534	253.9	2.88	9.5 , 9.7	36
1889.52	254.7	2.86	9.6 , 9.8	

The new star is not difficult.

β 1102. AOe. 1510.

RA. $1^h19^m38^s$ Decl. $+59°40'$.

B and C.

1889.583	335.6	0.93	10.5, 10.5	12
.586	335.3	0.82	10.5, 10.5	36
.589	338.0	0.77	10 , 10	36
1889.58	336.3	0.84	10.3, 10.3	

A and BC.

1889.583	265°3	60″30	8.5 , —	12
.586	265.4	60.26	8.5 , —	36
.589	265.6	60.31	8.5 , —	36
1889.58	265.4	60.29	8.5 , —	

The principal star is Radcl. 430, and is 1^m41^s f. δ Cassiopeiae, and 2′58″ n.

β 1103. 44 Cassiopeiae.

RA. $1^h35^m12^s$ Decl. $+59°56'$.

1889.526	7.8	1.63	6.5, 12.5	36
.534	1.4	1.81	6 , 13.5	36
.553	2.2	1.75	6 , 12	36
1889.54	3.8	1.73	6.2, 12.5	

β 1104. Groombridge 370.

RA. $1^h35^m51^s$ Decl. $+52°17'$.

1889.589	199.1	2.97	7 , 12	36
.611	195.2	2.82	7.3 , 12	36
.616	197.4	2.80	7.3 , 11.5	36
1889.60	197.2	2.86	7.2 , 11.8	

Found with the 12 inch.

β 1105. Pleiades.

RA. $3^h41^m26^s$ Decl. $+23°49'$.

1889.589	60.2	0 34	9.5 , 10	36
.594	58.4	0.33	8.8 , 10	36
.689	54.6	0.31	9.5 , 11	36
1889.62	57.7	0.33	9.3 , 10.3	

Rather difficult pair 1^m4^s f. and 4′3 n. of Alcyone. It is DM. +23°554.

β 1106. Pleiades.

RA. $3^h42^m58^s$ Decl. $+23°51'$.

1889.594	51.7	0.40	11.5, 11.5	36

Difficult pair; too faint for the DM. Place from the Paris map of the Pleiades. It is 55^s f. and 4′6 n. of 28 Tauri (Pleione).

β 1107. AOe_2 12884.

RA. $13^h20^m36^s$ Decl. $-21°44'$.

1889.351	130.5	1.36	8.5, 8.5	12
.373	135.9	—	8.6, 8.6	12
.375	135.8	—	—, —	12
.378	132.8	1.18	8.5, 8.5	36
.381	134.0	0.98	—, —	36
1887.37	133.8	1.17	8.5, 8.5	

β 1108. B.A.C. 4631.

RA. $13^h46^m32^s$ Decl. $-35°4'$.

A and B.

1889.373	81.3	1.48	6 , 6	12
.383	86.9	1.14	6 , 6	36
.386	83.9	1.21	— , —	36
1889.38	84.0	1.28	6 , 6	

A and D (= H_1 V.24).

1889.383	359°.1	65".25	—, 8.5	36
.386	359.0	65.18	—, —	36
1889.38	359.0	65.21	—, —	

A and C.

1889.386	168.2	27.52	—, 12	36

β 1109. DM. +5°2846.

RA. $14^h 3^m 18^s$ Decl. +5° 14'.

A and B.

1889.381	321.3	1.83	—, 13.5	36
.386	322.6	1.62	—, 14	36
.397	321.8	1.88	—, 13.5	36
1889.39	321.9	1.78	—, 13.7	

A and C.

1889.381	356.0	53.02	9, 9	36
.386	356.1	53.02	9, 9	36
.397	356.8	53.08	9, 9	36
1889.39	356.3	53.04	9, 9	

β 1110. Taylor 6665.

RA. $14^h 12^m 29^s$ Decl. —36° 18'.

1889.389	127.7	3.82	6.5, 12	12
.392	131.0	4.00	7.5, 12.5	12
.408	133.3	4.02	7, 12.5	12
1889.39	130.7	3.95	7.0, 12.3	

β 1111. Pi. $14^h 69$.

RA. $14^h 17^m 29^s$ Decl. +9° 0'.

B and C.

1889.397	136.8	0.21	8.5, 8.5	36
.400	133.4	0.17	8.3, 8.3	36
.403	135.8	0.20	8.5, 8.5	36
1889.40	135.3	0.19	8.4, 8.4	

A and BC (= Σ 1835).

1889.397	189.8	6.34	5, —	36
.400	189.4	6.39	5.5, —	36
.403	189.5	6.36	5.6, —	36
1889.40	189.6	6.36	5.4, —	

There seems to be but little if any change in the Σ stars:

1832.08 186°.5 6".06 Σ

β 1112. Lacaille 5983.

RA. $14^h 26^m 3^s$ Decl. —30° 11'.

1889.392	8.2	2.52	6.3, 12.5	12
.400	8.4	2.64	6, 12	36
.403	7.9	2.37	6.2, 11	36
.430	5.2	2.19	6.5, 10.5	12
.436	9.6	2.51	6, 10	36
.444	6.1	2.40	7, 10.8	12
1889.41	7.6	2.44	6.3, 11.1	

β 1113. B.A.C. 4886.

RA. $14^h 41^m 21^s$ Decl. +2° 32'.

1889.397	137°.1	4".63	6, 11.5	36
.400	136.7	4.42	6.5, 12.5	36
.403	137.6	4.58	6, 11.5	36
1889.40	137.1	4.54	6.2, 11.8	

Magnitude in DM. 7.7.

β 1114. B.A.C. 5090.

RA. $15^h 21^m 42^s$ Decl. —28° 27'.

A and B.

1889.373	319.7	0.73	7, 7.5	12
.383	325.8	0.52	7, 7.3	36
.386	331.5	0.69	7, 7	36
1889.38	325.7	0.65	7, 7.3	

AB and C (= H_2 4774).

1889.373	5.8	9.28	—, 11	12
.383	6.2	9.27	—, 9	36
.386	5.5	9.09	—, 9.5	36
1889.38	5.8	9.21	—, 9.8	

There seems to be no change in the angle of the wide pair, as Herschel found 8°.5 in 1834.

β 1115. Lal. 29840.

RA. $16^h 18^m 3^s$ Decl. —23° 11'.

1889.386	23.3	0.89	8, 9	36
.389	25.4	0.93	8, 9	12
.392	26.3	0.81	8.3, 8.8	12
.397	30.3	0.98	8, 10	36
1889.39	26.3	0.90	8.1, 9.2	

This star is a distant companion to ρ Ophiuchi, 156".43 distant, in the direction of 253°.0.

β 1116. B.A.C. 5600.

RA. $16^h 36^m 51^s$ Decl. —27° 14'.

1889.389	358.6	1.62	7, 12	12
.392	356.3	1.75	6.7, 12	12
.400	3.2	1.98	6.5, 11	36
1889.39	359.4	1.78	6.7, 11.7	

β 1117. 24 Ophiuchi.

RA. $16^h 49^m 34^s$ Decl. —22° 57'.

1889.389	262.4	0.88	6.5, 6.7	12
.392	260.2	0.72	6.5, 6.6	12
.397	268.9	0.59	6.3, 6.3	36
.403	265.5	0.60	6.5, 6.5	36
1889.39	264.2	0.70	6.4, 6.5	

β 1118. η Ophiuchi.

RA. 17h 3m 30s Decl. −15° 34′.

1889.383	270°.6	0″.31	4 , 4.5	36
.392	277.8	0.35	3 , 4	12
.397	276.9	0.38	3.5 , 3.7	36
.400	273.6	0.37	3 , 3.5	36
1889.39	274.7	0.35	3.4 , 3.9	

As the proper motion of this star is 0″.1 (in the direction of 2°.5), it is evident that this is a physical pair.

β 1119. B.A.C. 5820.

RA. 17h 9m 40s Decl. −30° 2′.

1889.392	350.1	0.74	7.5 , 8.0	12
.403	358.3	0.82	6.5 , 6.7	36
.422	359.0	0.69	7 , 8	36
1889.40	355.8	0.75	7.0 , 7.6	

Discovered with the 12 inch.

β 1120. B.A.C. 5896.

RA. 17h 21m 14s Decl. −25° 24′.

1888.636	99.8	0.98	7 , 7	12
9.392	98.4	0.91	7 , 7	12
9.400	101.9	0.91	7 , 7	36
1889.14	100.0	0.93	7 , 7	

Discovered with the 12 inch.

β 1121. DM. +12°.3264.

RA. 17h 31m 52s Decl. +12° 37′.

1888.636	241.5	0.73	— , —	12
9.392	240.5	0.73	8.5 , 9.0	12
9.403	239.4	0.68	8.5 , 9.0	36
1889.14	240.1	0.71	8.5 , 9.0	

This is 2m 30s f. α Ophiuchi, and 2′.5 s.

β 1122.

RA. 17h 44m 38s Decl. −28° 27′.

B and C.

1889.389	171.2	1.24	10.5, 11	12
.392	176.8	1.27	10.8, 11.3	12
.397	177.7	1.42	10 , 10.5	36
1889.39	175.2	1.31	10.4, 10.9	

A and BC (= Howe).

1889.389	10.6	6.59	— , 8.5	12
.392	7.4	6.59	— , 9	12
.397	10.9	6.20	— , 8.7	36
1889.39	9.6	6.46	— , 8.7	

The principal star is No. 24248 of the Argentine Catalogue. The wide pair was discovered by Howe at Cincinnati:

1880.44 8°.7 6″.54 Cinc. 2n.

β 1123.

RA. 17h 45m 20s Decl. −34° 42′.

1889.465	214°.1	0″.51	7.5, 8	12
.468	214.8	0.63	7 , 7.5	12
.473	203.9	0.66	7.5, 8	12
.508	218.2	0.54	7.5, 7.7	12
1889.48	212.8	0.58	7.4, 7.8	

In a large cluster. It is No. 24262 of the Argentin Catalogue.

β 1124. 67 Ophiuchi.

RA. 17h 54m 38s Decl. +2° 56′.

A and B.

1889.383	194.4	6.57	5 , 14	36
.397	197.6	6.96	— , 15	36
.400	194.9	6.83	— , 15.5	36
1889.39	195.6	6.79	5 , 14.8	

C and D (= β 634).

1889.397	130.6	8.47	8 , 11	36
.400	128.6	8.32	8.7, 12	36
1889.40	129.6	8.40	8.3, 11.5	

A and C (= South and Herschel 255).

1889.397	143.6	54.51	— , —	36
.400	143.6	54.57	— , —	36
2889.40	143.6	54.54	— , —	

Very little change in the wide pair:

1878.57 129°.2 8″.46 β 1n.
1878.57 143.0 54.70 β 1n.

β 1125. 68 Ophiuchi.

RA. 17h 55m 40s Decl. +1° 19′.

1889.383	18.0	0.83	5 , 10	36
.389	10.5	1.18	5 , 10	12
.392	13.1	0.93	5.5, 9.5	12
.397	18.0	1.18	5 , 10	36
.400	14.8	0.93	5 , 10	36
1889.39	14.9	1.01	5.1, 9.9	

β 1126. Yarn. 7599.

RA. 17h 56m 54s Decl. −24° 15′.

A and B.

1889.397	59.4	0.62	8.5, 9	36
.400	51.1	0.67	9 , 10	36
.403	54.4	0.63	9 , 10	36
.422	57.5	0.59	8.5, 8.8	36
1889.40	55.6	0.63	8.7, 9.5	

A and C (= H_2 5009).

1889.397	22.9	3.98	— , 9.5	36
.400	24.6	4.13	— , 10.5	36
.403	23.6	4.14	— , 9.5	36
.422	22.1	3.97	— , 9	36
1889.40	23.3	4.05	— , 9.6	

In Messier 8. The wide pair unchanged:

1837.70	20°.8	2″.±	H_2	1 n.
1880.58	19.9	3.86	Cinc.	1 n.

β 1127. Groombridge 2500.

RA. $17^h58^m59^s$ Decl. +44° 13′.

1889.523	143°.7	0″.67	8 , 10	12
.526	149.2	0.83	7.5, 9	12
.534	141.2	0.89	7.8, 10	36
1889.53	144.7	0.80	7.8, 9.7	

The magnitude in DM. is 6.5, and in Radcl. 7.2. Discovered with the 12 inch.

β 1128. B.A.C. 6285.

RA. $18^h23^m12^s$ Decl. −33° 4′.

1889.392	198.7	3.27	6 , 12.5	12
.447	198.4	3.14	6.2, 11	12
.458	198.6	3.11	6 , 11	12
1889.42	198.6	3.17	6.1, 11.5	

Discovered with the 12 inch.

β 1129. Groombridge 2829.

RA. $19^h18^m51^s$ Decl. +52° 9′.

1889.476	343.6	0.33	6.5, 6.5	36
.482	343.5	0.39	6 , 6	36
.499	345.7	0.31	6.5, 6.5	36
1889.48	344.3	0.34	6.3, 6.3	

The magnitude in DM. is 7.1.

β 1130. 9 Vulpeculae.

RA. $19^h29^m18^s$ Decl. +19° 23′.

1889.422	32.2	9.67	5.5, 13.5	36
.433	31.5	9.58	5.5, 14	36
.436	30.3	9.35	—, 15	36
1889.43	31.3	9.53	5.5, 14	

β 1131. θ Cygni.

RA. $19^h33^m13^s$ Decl. +49° 56′.

1889.323	45.2	3.59	5 , 14	36
.383	40.7	3.57	— , 14	36
.403	45.9	3.70	— , 15	36
1889.37	43.9	3.62	5 , 14.3	

The proper motion of this star is 0″.24 in the direction of 352°.4, so that in four years, if this motion is not common to both stars, the distance of the companion will be about 3″.1, and the angle 58°.

β 1132. W_2 19^h1204.

RA. $19^h38^m11^s$ Decl. +26° 39′.

1889.553	226.5	0.48	8 , 9	36
.556	226.5	0.53	8.5, 8.5	36
.559	229.0	0.46	8.5, 8.7	36
1889.56	227.3	0.49	8.3, 8.7	

β 1133. Lal. 38224.

RA. $19^h54^m56^s$ Decl. +31° 30′.

1889.553	340°.2	0″.84	7 , 9	36
.556	339.0	0.88	6.8, 9.5	36
.559	336.5	0.89	6.7, 10	36
1889.56	338.6	0.87	6.8, 9.5	

β 1134. DM. +63°1618.

RA. $20^h19^m29^s$ Decl. +63° 36′.

1889.476	81.7	4.24	5.5, 13	36
.482	79.7	4.38	6 , 12	36
.499	80.9	4.35	6 , 13	36
1889.48	80.8	4.32	5 8, 12.7	

This star is Rümker 8289, but is found only in these two star catalogues.*) It is singular that a naked-eye star should have been overlooked by so many meridian observers. The magnitude in the DM. is 5.9, and in Rümker 5.6.

*) Der Stern ist Nr. 11312 des Hels. AG. Catalogs; Grösse 5.5. *Kr.*

β 1135. Lal. 39561.

RA. $20^h25^m10^s$ Decl. +45° 20′.

1889.523	339.5	1.42	8.5, 10.7	12
.526	338.3	1.87	8.3, 10.8	12
.531	337.9	1.44	8.3, 10.3	36
.534	337.7	1 41	8 , 11	36
1889.53	338.3	1.53	8.3, 10.7	

Discovered with the 12 inch.

β 1136. Lal. 39698.

RA. $20^h28^m6^s$ Decl. +49° 8′.

1889.534	204.9	0.33	8 , 10	36
.537	207.4	0.40	8 , 10	36
.556	207.5	0.32	8.4, 9	36
1889.54	206.6	0.35	8.1, 9.7	

Discovered with the 12 inch.

β 1137. B.A.C. 7278.

RA. $20^h52^m36^s$ Decl. +50° 16′.

1889.436	344.0	6.99	6 , 13.5	36
.438	343.3	6.98	6 , 14	36
.460	345.7	6.66	6 , 13.5	36
1889.44	344.3	6.88	6 , 13.7	

β 1138. Lal. 40856.

RA. $20^h58^m34^s$ Decl. +45° 22′.

1889.436	187.1	0.29	7.5, 9.5	36
.438	193.1	0.27	7 , 8	36
.460	186.0	0.30	7 , 8	36
1889.44	188.7	0.29	7.2, 8.5	

The following of two stars. In DM. 6^m7.

β 1139. Radcl. 5088.
RA. 20h 58m 39s Decl. +56° 36′.

1889.323	139°.1	1".93	6 , 12.5	36
.383	136.3	1.76	6 , 13	36
.403	140.4	1.89	6 , 12	36
1889.37	138.6	1.86	6 , 12.5	

β 1140. Radcl. 5183.
RA. 21h 14m 1s Decl. +58° 6′.

1889.573	276.0	4.04	6.5 , 13	36
.578	276.3	3.95	6.7 , 12	36
.589	277.2	3.69	6.8 , 12	36
1889.58	276.5	3.89	6.7 , 12.3	

β 1141. AOe. 22270.
RA. 21h 22m 7s Decl. +57° 43′.

1889.573	165.5	2.69	7.5 , 13.5	36
.578	164.8	2.67	7.5 , 13	36
.589	167.4	2.79	8 , 13	36
1889.58	165.9	2.72	7.7 , 13.2	

β 1142. DM. +56°2579.
RA. 21h 25m 6s Decl. +56° 33′.

1889.578	355.0	0.46	8.7 , 8.7	36
.589	352.5	0.41	8.8 , 8.8	36
.592	354.2	0.35	8.7 , 8.7	36
1889.59	353.9	0.41	8.7 , 8.7	

β 1143. Pi. 21h248.
RA. 21h 35m 14s Decl. +56° 57′.

A and B.

1889.611	325.0	1.52	6 , 14	36
.616	322.0	1.59	— , 13.5	36
.630	323.6	1.53	— , 13.5	36
1889.62	323.5	1.55	6 , 13.7	

A and C (= Σ 2816).

1889.611	120.2	11.93	— , 7.5	36
.613	120.0	11.76	— , 7.5	36
.616	121.2	11.88	— , 7	36
1889.61	120.4	11.86	— , 7.3	

A and D (= Σ 2816).

1889.611	339.6	19.92	— , 7.5	36
.613	339.8	19.98	— , 7.5	36
.616	339.1	19.91	— , 7	36
1889.61	339.5	19.94	— , 7.3	

No change in the Σ stars:

1832.94	120°.1	11".66	Σ
1832.94	339.7	19.96	Σ

β 1144. η Pegasi.
RA. 22h 37m 23s Decl. +29° 36′.

B and C.

1889.526	83°.2	0".33	10 , 10	36
.534	85.5	0.26	10 , 10	36
.537	82.9	0.27	10 , 10	36
.540	81.7	0.31	10.5, 10.5	36
1889.53	83.3	0.29	10.1, 10.1	

A and BC (= H_1 VI.21).

1889.526	339.0	90.27	3 , —	36
.534	339.2	90.43	— , —	36
.537	339.0	90.39	— , —	36
.540	338.9	90.44	— , —	36
1889.53	339.0	90.38	— , —	

There are no measures of the distant star in H but from South's observations it would appear unchange

1824.85 338°.9 89".82 S 2n.

β 1145. AOe. 24690.
RA. 22h 42m 45s Decl. +57° 55′.

A and B.

1889.578	154.2	0.98	8 , 10.5	36
.589	151.4	0.97	8 , 11.5	36
.611	153.5	1.14	8.5, 11	36
1889.59	153.0	1.03	8.2, 11.0	

A and C.

1889.578	179.4	21.98	— , 9.3	36
.589	179.6	22.01	— , 9.8	36
.611	179.5	21.98	— , 9.5	36
1889.59	179.5	21.99	— , 9.5	

β 1146. W_2 22h971.
RA. 22h 42m 48s Decl. +30° 28′.

1889.537	336.2	0.25	7 , 8.5	36
.540	336.6	0.19	7.5, 8.5	36
.570	333.2	0.24	7 , 7.5	36
1889.55	335.3	0.23	7.2, 8.2	

β 1147. 2 Andromedae.
RA. 22h 57m 5s Decl. +42° 7′.

1889.534	317.3	0.28	5 , 8.5	36
.537	317.6	0.29	5 , 8.5	36
.556	318.5	0.27	5 , 9	36
1889.54	317.8	0.28	5 , 8.7	

Suspected with the 12 inch, and verified and measur with the large telescope.

β 1148. Groombridge 4070.

RA. $23^h22^m12^s$ Decl. $+64°58'$.

1889.592	71°0	2".06	6.7, 13	36
.594	76.4	2.20	7, 13	36
.611	74.3	2.13	7.5, 13	36
1889.60	73.9	2.13	7.1, 13	

The magnitude in DM. is 6.5.

β 1149. DM. $+57°2746$.

RA. $23^h24^m11^s$ Decl. $+58°1'$.

1889.578	311.0	0.50	9.5, 10	36
.586	305.4	0.53	9.3, 9.8	36
.589	311.0	0.52	9.5, 9.7	36
1889.58	309.1	0.52	9.4, 9.8	

This star is in the field with $O\Sigma$ 496 ; distance 231".07, in the direction of 207°6.

β 1150. AOe. 25672.

RA. $23^h24^m46^s$ Decl. $+64°24'$.

1889.594	46.2	0.63	8.5, 8.5	36
.597	40.7	0.57	9, 9.5	36
.608	45.0	0.62	8.7, 9	36
1889.60	44.0	0.61	8.7, 9.0	

β 1151.

RA. $23^h25^m6^s$ Decl. $+57°43'$.

1889.578	295.2	0.62	9.5, 9.7	36
.586	291.7	0.72	9.7, 9.7	36
.589	294.2	0.57	9.8, 9.8	36
1889.59	293.7	0.64	9.7, 9.7	

This is too small a star to be included in the DM. It is near Σ 3022. The following measures give its place from that pair :

Σ 3022 and new pair.

1889.578	189.7	116.57	—, —	36
.586	189.8	117.05	—, —	36
.589	189.7	117.03	—, —	36
1889.58	189.7	116.88	—, —	

β 1152. Groombridge 4142.

RA. $23^h42^m17^s$ Decl. $+63°9'$.

B and C.

1889.594	99°1	0".69	9, 9	36
.597	103.2	0.66	9, 9	36
.608	105.8	0.56	9.5, 9.6	36
1889.60	102.4	0.64	9.2, 9.2	

A and BC.

1889.594	136.0	74.31	—, 7.5	36
.597	136.8	74.32	—, 7.5	36
.608	136.1	74.20	—, 7.5	36
1889.60	136.3	74.28	—, 7.5	

β 1153.

RA. $23^h46^m45^s$ Decl. $+60°2'$.

A and B.

1889.673	321.2	0.40	9.5, 9.6	36
.687	316.0	0.45	—, —	36
.689	322.1	0.40	9.7, 10	36
.692	314.9	0.48	10, 10.2	36
1889.68	318.5	0.43	9.7, 9.9	

AB and C.

1889.673	339.8	13.80	—, 9.8	36
.687	339.1	13.61	—, —	36
.689	339.5	13.74	—, 10.5	36
1889.68	339.5	13.72	—, 10.1	

$O\Sigma$ 511 and β 1153.

1889.687	246.0	176.48	—, —	36
.689	246.0	176.55	—, —	36
1889.69	246.0	176.51	—, —	

In the field and preceding $O\Sigma$ 511. The new pair is not in the DM.

β 1154. DM. $+73°1068$.

RA. $23^h55^m12^s$ Decl. $+74°10'$.

1889.512	134.7	1.12	8, 8.2	12
.515	308.5	0.88	8, 8	36
.518	307.0	0.93	8, 8.2	36
1889.51	310.1	0.98	8, 8.2	

Discovered with the 12 inch.

Measures of Double Stars.

β Cassiopeiae.

RA. $0^h2^m43^s$ Decl. $+58°29'$.

1889.589	189°4	22".61	2, 14	36
.592	188.9	22.54	—, 13.5	36
.594	189.3	22.74	—, 13.5	36
1889.59	189.2	22.63	—, 13.7	

This very minute companion was detected, I think, by Mr. Alvan G. Clark. I do not know with what aperture it was first seen. I have a recollection of his mentioning some years ago that he had seen a faint companion to β Cassiopeiae. The Struve 30 inch refractor was probably the instrument used.

β 253.

RA. $0^h4^m5^s$ Decl. $+57°51'$.

1888.733	50°6	0".68	8.5, 8.5	12
9.553	50.2	0.66	8, 8.2	36
9.556	51.6	0.60	8.3, 8.3	36
1889.28	50.8	0.65	8.3, 8.3	

The only prior measures are :

1875.95 49°9 0".42 De 5n.

β 485.

RA. $0^h 4^m 30^s$ Decl. $+58° 6'$.

1889.537	306°.9	0".46	8.5, 8.6	36
.553	307.8	0.42	8.4, 8.5	36
.556	307.5	0.45	8.5, 8.5	36
1889.55	307.4	0.44	8.5, 8.6	

The only other measures are:

1878.17 148°.5 0".41 β 2n.

β 486. Ceti 33.

RA. $0^h 8^m 19^s$ Decl. $-8° 27'$.

1888.914	5.3	3.09	5, 11	36

Σ 13.

RA. $0^h 9^m 25^s$ Decl. $+76° 17'$.

1889.323	91.5	0.76	6.5, 6.6	36
.392	89.8	0.87	6, 6.1	12
.397	91.9	0.75	6, 6	36
.512	93.7	0.86	6.5, 6.7	12
1889.41	91.7	0.81	6.2, 6.3	

Binary system, in slow retrograde motion.

α Cassiopeiae.

RA. $0^h 33^m 42^s$ Decl. $+55° 53'$.

A and B.

1889.594	273.1	17.61	—, 14.5	36
.608	271.6	17.55	—, —	36
.611	272.5	17.51	—, 14.5	36
1889.60	272.4	17.56	—, 14.5	

A and C.

1889.594	105.7	39.65	—, 14	36
.608	105.5	39.40	—, —	36
.611	106.2	40.12	—, 14	36
1889.60	106.5	39.72	—, 14	

A and D (= H_2 1993).

1889.594	280.0	63.27	—, 9	36
.608	280.1	62.96	—, 9	36
.611	280.4	63.36	—, 9	36
1889.60	280.2	63.20	—, 9	

The nearest star, B, has not been seen before. The second companion, C, was added with the Chicago $18\frac{1}{2}$ inch. My measures of this and the Herschel star are as follows:

1878.11 108°.7 40".07 β 2n. AC
1878.11 279.9 62.38 β 2n. AD

β 492. B.A.C. 201.

RA. $0^h 38^m 28^s$ Decl. $+54° 34'$.

1889.547	150.9	2.09	5.5, 11.5	36
.553	153.1	2.08	5.8, 11.5	36
.556	154.2	2.16	5.7, 11	36
1889.55	152.7	2.11	5.7, 11.3	

The only earlier measure is the following:

1878.73 152°.6 1".90 β 2n.

β 1.

RA. $0^h 45^m 45^s$ Decl. $+55° 58'$.

A and B.

1889.540	80°.9	1".62	8, 10	36
.556	82.8	1.54	8.2, 9.5	36
.570	84.1	1.20	8.5, 10	36
1889.55	82.6	1.45	8.2, 9.8	

A and C.

1889.540	134.9	3.87	—, 8.7	36
.556	134.3	3.82	—, 8.6	36
.570	133.5	3.77	—, 8.7	36
1889.55	134.2	3.82	—, 8.7	

A and D.

1889.540	193.2	9.04	—, 8.7	36
.570	194.2	8.90	—, 8.8	36
1889.55	193.7	8.97	—, 8.7	

A and E.

1889.540	332.8	15.83	—, 13	36
.556	333.1	15.82	—, 12	36
.570	333.4	15.88	—, 12.5	36
1889.55	333.1	15.84	—, 12.5	

For comparison we have:

1875.34	81°.0	1".42	De 4n. AB
1875.34	133.3	3.70	De 4n. AC
1875.34	192.9	8.82	De 4n. AD

β 1028. γ Cassiopeiae.

RA. $0^h 48^m 50^s$ Decl. $+60° 1'$.

1889.512	255.1	2.05	—, 11.5	36
.526	256.5	2.22	—, 11.5	36
.534	254.2	2.25	—, 11.5	36
.553	255.8	2.09	—, 12	36
1889.53	255.4	2.15	—, 11.6	

The measures of last year gave:

1888.69 255.9 2.18 β 6n.

β 396.

RA. $0^h 56^m 13^s$ Decl. $+60° 26'$.

1889.534	67.3	1.18	6, 10	36
.537	65.7	1.40	6, 9.8	36
.553	66.1	1.27	6, 10	36
1889.53	66.4	1.28	6, 10	

β 235.

RA. $1^h 3^m 27^s$ Decl. $+50° 22'$.

A and B.

1889.523	85.7	0.76	7.5, 7.6	12
.534	85.9	0.79	7, 7	36
.553	86.6	0.82	7, 7.3	36
1889.53	86.1	0.79	7.2, 7.3	

This star, with distant companions, is $O\Sigma$ 24. There appears to be some change in the close pair:

1875.65	74°.0	0".48	De	6n.
1883.75	78.5	0.59	En	6n.

β 258.

RA. $1^h 5^m 29^s$ Decl. $+61° 4'$.

1889.537	266°.5	1".00	6.5, 10	36
.578	268.0	1.01	6.5, 9	36
.589	270.0	0.97	6, 10	36
1889.57	268.2	0.99	6.3, 9.7	

This may have slow motion in angle and distance:

1875.20	260°.4	0".79	De	4n.
1881.63	264.4	0.89	β	3n.

β 305. Persei 58.

RA. $1^h 30^m 52^s$ Decl. $+37° 13'$.

1888.706	205.2	20.76	6.5, 10.8	12
.709	205.9	20.79	7.5, 10.5	12
1888.71	205.5	20.77	7.0, 10.7	

β 513. 48 Cassiopeiae.

RA. $1^h 52^m 7^s$ Decl. $+70° 19'$.

1889.512	302.6	0.72	5, 10	36
.515	305.3	0.66	5, 8	36
.537	305.3	0.91	—, —	36
1889.52	304.4	0.76	5, 9	

The measures made here last year gave:

1888.70	298°.1	0".83	β	4n.

β 785. 49 Cassiopeiae.

RA. $1^h 54^m 4^s$ Decl. $+75° 32'$.

1889.512	245.3	5.40	5.3, 12.5	36
.515	245.7	5.30	5, 13.5	36
.537	241.0	5.50	5, 13.5	36
1889.52	243.7	5.40	5.1, 13.2	

The only other measures are:

1881.70	245°.7	5".22	β	4n.

$O\Sigma$ 38. γ Andromedae.

RA. $1^h 56^m 32^s$ Decl. $+41° 45'$.

B and C.

1889.515	98.2	0.09	—, —	36

Now a very difficult pair. The measured distance is not too large. The components are probably separating.

Σ 279.

RA. $2^h 28^m 15^s$ Decl. $+36° 47'$.

1888.706	70.3	18.00	6.5, 11	12
.709	70.4	17.47	7.3, 10.5	12
1888.71	70.3	17.73	6.9, 10.7	

β 524. 20 Persei.

RA. $2^h 46^m 9^s$ Decl. $+37° 51'$.

A and B.

1888.681	83°.9	0".23	6, 6	12
1889.594	291.3	0.17	5.5, 6	36

The distance of this very difficult pair is decreasing. The only other measures are the following:

1878.66	158°.7	0".34	β	3n.
1880.82	323.1	0.29	β	4n.
1881.67	334.9	0.28	β	1n.

Σ 412. 7 Tauri.

RA. $3^h 27^m 20^s$ Decl. $+24° 4'$.

A and B.

1889.589	36.9	0.31	6, 6	36
.594	37.4	0.29	6.3, 6.3	36
.687	34.7	0.32	6, 6	36
.689	36.7	0.29	6, 6	36
1889.64	36.4	0.30	6, 6	

AB and C.

1889.589	59.7	22.15	—, 9	36
.594	59.9	22.20	—, 9.5	36
.687	59.6	22.04	—, 9.5	36
1889.62	59.7	22.13	—, 9.3	

H_2 4478. β Hydrae.

RA. $11^h 46^m 51^s$ Decl. $-33° 14'$.

1889.427	349.2	1.57	—, —	12
.430	350.0	1.52	—, —	12
.433	349.5	1.49	—, —	12
1889.43	349.6	1.53	—, —	

β 413.

RA. $13^h 42^m 15^s$ Decl. $-27° 46'$.

1889.392	109.5	77.74	8, 10	12
.397	109.5	77.58	7.5, 8.5	36
1889.39	109.5	77.66	7.7, 9.2	

Large star deep red.

β 343. Centauri 219.

RA. $13^h 45^m 8^s$ Decl. $-31° 1'$.

1889.351	129.2	1.98	6, 8.5	12
.373	129.3	2.11	6.7, 7.2	12
.383	129.2	1.28	6, 6.3	36
.386	131.2	1.41	6, 6.2	36
1889.37	129.7	1.70	6.2, 7.1	

β 614.

RA. $13^h 48^m 2^s$ Decl. $+10° 44'$.

1889.383	270.4	0.43	8, 11	36
.400	273.4	0.41	7.5, 11.5	36
.406	269.4	0.49	8, 11	36
1889.40	271.1	0.44	7.8, 11.2	

This is $O\Sigma$ 271 rej. The only other measures are

1878.38	268°.3	0".60	β	2n.

Swift.

RA. $13^h57^m40^s$ Decl. $+46°55'$.

1889.386	8°2	2".27	8.5, 8.5	36
.389	5.2	2.62	9.5, 9.5	12
1889.39	6.7	2.44	9, 9	

Discovered by Dr. Lewis Swift in the course of his work on nebulae. It has not been measured before.

β 940. 52 Hydrae.

RA. $14^h21^m9^s$ Decl. $-28°57'$.

1889.378	279.3	4.05	—, 11	36
.383	279.3	4.22	—, 10.5	36
.386	277.5	4.53	—, 11	36
1889.38	278.7	4.27	—, 10.8	

The only prior measures are as follows:

1879.42 276°8 4".00 β 3n.

β 414. Centauri 315.

RA. $14^h34^m42^s$ Decl. $-30°25'$.

1889.427	342.9	1.10	6.5, 7.3	12
.430	347.0	1.01	—, —	12
.436	347.0	0.91	6.5, 8.5	36
1889.43	345.6	1.01	6.5, 7.9	

This is the first measure of this pair.

Hn 20. 5 Librae.

RA. $14^h39^m21^s$ Decl. $-14°57'$.

1889.378	247.4	2.53	6.5, 11	36
.383	252.1	2.90	6, 11.5	36
.386	248.2	2.93	6, 11.5	36
1889.38	249.2	2.79	6.2, 11.3	

The only earlier measures are:

1881.43 249°8 2".69 β 3n.

β 106. μ Librae.

RA. $14^h42^m45^s$ Decl. $-13°39'$.

A and B.

1889.378	342.7	1.53	5, 6	36
.383	340.0	1.67	—, —	36
.386	339.2	1.64	—, —	36
1889.38	340.6	1.61	—, —	

A and C.

1889.383	283.1	18.25	—, 15	36
.386	284.3	18.41	—, 14	36
1889.38	283.7	18.33	—, 14.5	

A and D.

1889.378	185.8	25.39	—, 13.5	36
.383	185.4	26.29	—, 13.5	36
.386	185.2	26.21	—, 14	36
1889.38	185.5	25.96	—, 13.9	

A and E.

1889.378	233°0	27".28	—, 13	36
.383	232.5	27.04	—, 13	36
.386	232.1	27.26	—, 12.5	36
1889.38	232.5	27.19	—, 12.8	

The faint star, C, is now noted for the first time There is probably slow direct motion in the close pair There are two other faint stars in the direction of 74°7 and 56°5 respectively, a little farther than E.

β 447. Centauri 330.

RA. $14^h47^m18^s$ Decl. $-32°49'$.

A and B.

1889.444	320.5	12.79	6, 10	12
.447	321.0	13.04	6.5, 10.5	12
.465	320.4	13.20	7, 11	12
1889.45	320.6	13.01	6.5, 10.5	

A and C.

1889.444	242.9	58.42	—, 9.5	12
.447	243.5	58.41	—, 10	12
.465	242.9	58.55	—, 10	12
1889.45	243.1	58.46	—, 9.8	

No other measures.

β 239. 59 Hydrae.

RA. $14^h51^m23^s$ Decl. $-27°10'$.

1889.430	309.0	0.78	6, 6.1	12
.436	315.2	0.99	5.5, 5.5	36
.438	310.1	0.81	6, 6.2	36
1889.44	311.4	0.86	5.8, 5.9	

Very little, if any, change, although some of the measures are discordant.

Σ 1926.

RA. $15^h10^m23^s$ Decl. $+38°45'$.

1889.288	258.0	1.29	7, 9	36
.389	256.8	0.96	8, 9.5	12
.392	258.2	1.05	8, 9	12
1889.35	257.7	1.10	7.7, 9.2	

β 121. B.A.C. 5163.

RA. $15^h32^m20^s$ Decl. $-27°15'$.

1889.447	276.9	1.48	7.5, 7.7	12
.468	276.7	1.49	8.7, 8.7	12
.505	278.8	1.37	8.5, 8.5	12
1889.47	277.5	1.45	8.2, 8.2	

Probably unchanged:

1876.90 278°6 1".67 Cinc. 2n.

β 947. β Scorpii.

RA. 15h58m28s Decl. −19°29′.

1889.383	91°6	0″88	—, 11	36
·397	95·5	1.13	—, 11	36
·422	94.9	0.89	—, 11	36
·430	89.9	0.86	—, 10.5	12
·438	97.4	0.94	—, 10.5	36
1889.41	93·9	0.94	—, 10.8	

This will certainly prove to be a physical pair, but the change thus far, if any, is very slow:

1880.06	88°4	0″91	β 6n.
1881.50	92.7	0.96	β 3n.

β 811.

RA. 16h0m4s Decl. +22°30′.

1889.473	220.2	3.72	8, 11	36
·479	221.5	3.59	7.5, 10.5	36
·534	220.3	3.78	8, 11	36
1889.49	220.7	3.70	7.8, 10.8	

The only other measures are:

1881.31	221°6	3″49	β 3n.

β 120. ν Scorpii.

RA. 16h5m1s Decl. −19°9′.

A and B.

1889.430	1.4	0.83	—, —	12
·438	1.9	0.81	—, —	36
·465	0.2	0.75	—, —	12
1889.44	1.2	0.80	—, —	

Sh. 228. ρ Ophiuchi.

RA. 16h18m23s Decl. −23°10′.

A and B.

1889.386	354.1	3.34	—, —	36
·389	355.4	3.46	5.5, 5.8	12
·392	355.5	3.43	5.5, 5.7	12
1889.39	355.0	3.41	5.5, 5.8	

A and C.

1889.389	359.7	150.98	—, 8	12
·392	0.0	151.41	—, 8	12
1889.39	359.8	151.15	—, 8	

A and D.

1889.386	253.3	156.05	—, —	36
·389	252.8	156.39	—, 8	12
·392	252.8	156.84	—, 8	12
1889.39	253.0	156.43	—, 8	

The distant star, D, is a close pair, and will be found in the list of new pairs.

β 815.

RA. 16h23m16s Decl. +43°11′.

1889.425	343°4	7″63	8.5, 10	36
·430	342 4	7.68	8.5, 11.8	12
·436	344.1	7.72	8.5, 10.5	36
1889.43	343.3	7.68	8.5, 10.8	

The distance is increasing, probably from proper motion.

1881.30	348°4	6″42	β	3n.
1886.40	344.5	7.28	En	6n.

Σ 2118. 20 Draconis.

RA. 16h55m49s Decl. +65°13′.

1889.403	140.8	0.10est.	—, —	36
·463	136.8	0.10	5 5, 6	36
·499	144.4	0.14	—, —	36
1889.45	140 7	0.11	—, —	

The measured distance is certainly not too small. This pair has been regarded as single for many years. The last preceding measure is the following:

1880.82	211°3	0″2	β 4n.

β 823.

RA. 17h0m29s Decl. +0°49′.

1889.468	0.9	1.05	9, 10	12
·473	359.7	1.25	8.5, 9	36
·508	358.8	1.22	8.5, 9.5	12
1889.48	359.8	1.17	8.7, 9 5	

The only earlier measures are:

1881.39	353°9	1″04	β 4n.

β 125.

RA. 17h4m43s Decl. −26°53′.

1889.447	63.6	1.38	7.6, 9	12
·468	56.4	1.60	8, 10	12
·505	61.9	1.47	8, 11	12
1889.47	61.3	1.48	7.9, 10	

β 282.

RA. 17h8m29s Decl. −14°27′.

1889.406	152.4	4.25	6, 11	36
·422	152.0	4.33	6.5, 11	36
·430	151.2	4.35	6.5, 12	12
1889.42	151.9	4.31	6.3, 11.3	

No sensible change in this pair.

β 957.

RA. 17h8m57s Decl. −10°10′.

1889.473	201.9	0 45	8, 8.2	36
·512	202.8	0.46	8.3, 8.5	36
·515	200.3	0.51	8.3, 8.5	36
1889.50	201.7	0.47	8.2, 8.4	

The only other measures are:

1880.16	23°6	0″58	β	3n	7.9	7.9.

β 416. B.A.C. 5825.

RA. $17^h10^m47^s$ Decl. $-34°51'$.

A and B.

1888.717	147°.5	1".88	6 , 7.5	12
9.392	135.0	1.39	6 , 6.5	12
9.447	132.0	1.50	6.2 , 8	12
9.465	135.3	1.17	7 , 8	12
1889.25	137.4	1.48	6.3, 7.5	

AB and C (= H_2 4935).

1889.392	128.4	30.80	— , 11	12
.447	128.1	30.75	— , 10	12
.465	129.4	31.55	— , 10.5	12
1889.43	128.6	31.03	— , 10.5	

Swift.

RA. 17^h15^m Decl. $+53°47'$.

1889.433	131.0	0.63	8.6, 8.7	36
.436	133.3	0.50	9 , 9.1	36
.438	131.7	0.59	9 , 9	36
1889.43	132.0	0.57	8.9, 9.0	

Discovered by Dr. Lewis Swift. No other measures.

β 962. 26 Draconis.

RA. $17^h33^m44^s$ Decl. $+61°58'$.

1889.403	127.8	0.90	5 , 11	36
.406	131.6	0.99	4.5, 11	36
.422	131.5	1.01	— , 11	36
.438	129.4	0.88	— , 11	36
1889.42	130.1	0.95	— , 11	

Evidently a binary. The large proper motion (0".582 in 152°.2) is common to both stars. The distance is decreasing, and it is now more difficult than formerly. The following are all the measures:

1879.97	151°.8	1".37	β 4 n.
1881.53	148.1	1.31	β 3 n.

A. C. 7. μ Herculis.

RA. $17^h41^m47^s$ Decl. $+27°48'$.

B and C.

1889.502	359.3	0.58	10 , 10.2	36
.512	358.2	0.54	9.8 , 10	36
.515	355.5	0.57	10 , 10.3	36
.518	357.7	0.51	10 , 10.3	36
1889.51	357.9	0.55	10 , 10.1	

Mr. A. C. Leuschner has computed the orbit of this pair, using the foregoing measures, and finds a period of 45.24 years.

β 825.

RA. $17^h58^m20^s$ Decl. $+25°22'$.

A and B.

1889.473	195.1	11.35	— , 11	36
.479	194.4	11.00	— , 11.5	36
.482	194.2	11.25	— , 11.5	36
1889.47	194.6	11.20	— , 11.3	

A and C (= Σ 2268).

1889.468	211°.4	20".16	8.5 , 8.8	12
.473	211.3	20.09	8.5 , 8.8	36
.479	212.3	19.75	8.5 , 8.8	36
.482	211.3	20.08	8.3 , 8.7	36
1889.47	211.6	20.00	8.5 , 8.8	

The change is probably due to proper motion.

Σ 2272. 70 Ophiuchi.

RA. $17^h59^m23^s$ Decl. $+2°33'$.

1889.30 Both stars single with 36 inch.

$O\Sigma$ 342. 72 Ophiuchi.

RA. $18^h1^m42^s$ Decl. $+9°33'$.

1889.30. Large star single with 36 inch, a near companion.

A. C. 15. 99 Herculis.

RA. $18^h2^m28^s$ Decl. $+30°33'$.

1889.502	281.2	0.65	6 , 11.5	36

I was unable to see the smaller component last It is now very difficult, and although seen for an on two or three other nights, I could not get a satisf measure. The following are all the measures:

1859.63	347°.1	1".71	Da	2 n.
1878.46	24.4	0.99	β	3 n.
1880.18	29.9	0.91	β	3 n.
1881.43	29.4	0.51	β	1 n.

Evidently a binary in rapid movement. For reason it is extraordinarily difficult for the assigned tudes and distance.

β 759.

RA. $18^h3^m54^s$ Decl. $-39°32'$.

A and B.

1889.389	121.7	1.80	9 , 9.3	12
.392	120.7	1.94	9 , 9.3	12
.430	121.7	1.68	8.6 , 8.7	12
1889.40	121.4	1.81	8.9 , 9.1	

A and C (= H_2 5028).

1889.389	146.4	14.99	— , 9.2	12
.392	147.9	15.05	— , 9.2	12
.430	147.6	14.71	— , 8.5	12
1889.40	147.3	14.92	— , 9.0	

β 760. η Sagittarii.

RA. $18^h9^m31^s$ Decl. $-36°48'$.

A and B.

1889.389	106.1	3.89	4 , 11.5	12
.392	110.8	3.32	4 , 11.5	12
.430	104.5	3.42	4 , 11	12
.438	106.8	3.40	5 , 11.5	12
1889.41	107.0	3.51	— , 11.4	

A and C.

1889.389	302°.5	93".25	—, 10	12
.438	303.1	93.20	—, 10	12
1889.41	302.8	93.22	—, 10	

$O\Sigma$ 357.

RA. $18^h 30^m 21^s$ Decl. $+11° 37'$.

1888.627	252.5	0.40	8, 8	12
9.502	253.9	0.40	8.5, 8.5	36
9.512	251.9	0.46	8, 8.2	36
1889.21	252.8	0.43	8.2, 8.2	

Probably a binary, but the motion is very slow.

ζ Lyrae.

RA. $18^h 40^m 38^s$ Decl. $+37° 29'$.

A and B.

1889.425	48.6	26.79	—, 15.5	36
.433	48.8	27.08	—, 16	36
1889.43	48.7	26.93	—, 15.7	

A and C (= Σ 38 App. I).

1889.425	149.5	43.77	—, —	36
.433	149.2	43.70	—, —	36
1889.43	149.3	43.73	—, —	

The very faint star, B, has not been seen before. It is much more difficult than the companion found with the $18\frac{1}{2}$ inch, 43".37 from the principal star, in the direction of 274°.4.

Σ 2400.

RA. $18^h 43^m 32^s$ Decl. $+16° 7'$.

A and B.

1889.460	190.8	1.65	8, 11.2	36
.471	188.7	1.64	8, 11.1	36
.473	187.4	1.60	8.5, 11	36
.482	189.2	1.55	8.5, 11.1	36
1889.47	189.0	1.61	8.2, 11.1	

A and C (= Σ 2400).

1889.460	193.0	2.38	—, 11	36
.471	190.4	2.67	—, 11	36
.473	192.3	2.54	—, 11	36
.482	191.0	2.56	—, 11	36
1889.47	191.7	2.54	—, 11	

B and C.

1889.473	17.5	0.84	—, —	36
.482	17.6	0.78	—, —	36
1889.48	17.5	0.81	—, —	

The small star, B, was discovered by Perrotin, and independently by Young with the Princeton 23 inch. The change in the position of the Struve companion is due to the proper motion of A. B and C appear to be relatively fixed. As they are of substantially the same magnitude, it is singular that Struve and later observers should have failed to see the other companion. As a matter of fact, the latter was measured by $O\Sigma$ in 1872 for the old companion.

Σ 3130 = $O\Sigma$ 365.

RA. $18^h 52^m 20^s$ Decl. $+44° 4'$.

1889.460, .463 The principal star is certainly single with powers up to 1900 on the 36 in. As this star has not been seen double in the last thirty years, it would almost seem that some mistake had been made in the observations of this as a close pair.

ζ Sagittarii.

RA. $18^h 55^m 0^s$ Decl. $-30° 3'$.

1889.389	252.4	1.06	—, —	12
.392	254.2	0.70	3.5, 3.6	12
.397	258.9	0.79	—, —	36
.430	253.6	0.66	—, —	12
.438	256.6	0.82	4, 4.2	12
1889.41	255.1	0.81	—, —	

Σ 2438.

RA. $18^h 55^m 29^s$ Decl. $+58° 4'$.

1889.460	46.0	0.22	7, 7	36
.463	43.7	0.23	7, 7.1	36
.470	48.9	0.26	7.5, 7.7	36
1889.46	46.2	0.24	7.2, 7.3	

This star has been apparently single with ordinary instruments for many years. In the above measures, particular attention was given to the proper quadrant.

γ Coronae Australis.

RA. $18^h 58^m 18^s$ Decl. $-37° 14'$.

1889.389	185.3	2.05	5.5, 5.5	12
.392	187.0	1.54	—, —	12
.430	183.6	1.84	—, —	12
.438	185.7	1.73	5.5, 5.5	12
1889.41	185.4	1.79	5.5, 5.5	

β 287. ζ Aquilae.

RA. $18^h 59^m 54^s$ Decl. $+13° 41'$.

1889.422	56.5	5.70	—, —	36
.433	58.5	5.56	—, 13	36
.436	56.8	5.64	—, 13	36
1889.43	57.3	5.63	—, 13	

Very little change in this pair.

β 654. 52 Sagittarii.

RA. $19^h 29^m 24^s$ Decl. $-25° 10'$.

1889.392	159.3	2.98	5, 11	12
.430	159.1	2.97	4.5, 11.5	12
.433	159.2	3.01	5, 12	36
.438	158.7	3.06	6, 11.5	12
1889.42	159.1	3.00	5.1, 11.5	

The following are all the measures:

1878.57	160°.8	2".93	β	3n.
1878.72	163.2	2.64	Cinc.	2n.

β 761.

RA. $19^h 31^m 45^s$ Decl. $-39° 42'$.

1889.392	197°.6	2".42	8 , 10	12
.430	199.6	2.52	7.5 , 10.5	12
.438	197.3	2.40	7.5 , 10	12
1889.42	198.2	2.45	7.7 , 10.2	

The following are all the measures:

1879.68	197°.4	—	β	3n.
1886.71	198.7	2".55	Rus.	1n.

$O\Sigma$ 380. χ Aquilae.

RA. $19^h 36^m 55^s$ Decl. $+11° 33'$.

1889.592. I have never been able to see with any telescope the third star noted by some of the earlier observers. The 36inch fails to show any other than the well known components.

β 658. B.A.C. 6762.

RA. $19^h 39^m 1^s$ Decl. $+26° 50'$.

1889.553	301.8	0.54	6.5 , 10	36
.556	298.7	0.50	6.8 , 9.5	36
.559	299.3	0.45	6.8 , 9.5	36
1889.56	299.9	0.50	6.7 , 9.7	

The only previous measure is:

1878.53 295°.2 0".57 β 1n.

A. C. 9. ζ Sagittae.

RA. $19^h 43^m 39^s$ Decl. $+18° 51'$.

1889.559	8.4	0.12	4 , 5	36
.592	1.6	0.12	4 , 4	36
1889.57	5.0	0.12	— , —	

The following are all the other measures:

1875.8	316°.9	—	De	3n.
1878.11	157.6	0".29	β	5n
1880.20	153.3	0.31	β	3n.
1883.41	176.6	0.17	En	8n.

It is much closer and more difficult now than formerly. Perhaps 180° should be added to my last angles to make them correspond to the other measures.

β 980. η Cygni.

RA. $19^h 51^m 48^s$ Decl. $+34° 46'$.

A and B.

1889.509	214.6	7.12	4 , 13	36
.512	209.4	7.21	— , 13	36
.515	207.8	7.31	— , 13	36
.518	210.0	7.19	— , 12.5	36
1889.51	210.4	7.21	— , 13	

A and C (= H_2 1455).

1889.512	326.1	46.17	— , 11.2	36
.515	326.3	45.98	— , 10.7	36
1889.51	326.2	46.08	— , 11	

A and D (= H_2 1455).

1889.512	169°.2	49".81	— , 11	36
.515	169.0	49.84	— , 10.5	36
1889.51	169.1	49.82	— , 10.7	

The only prior measure of the nearer star is:

1879.89 209°.6 7".07 β 5n.

Ho. 121.

RA. $20^h 7^m 25^s$ Decl. $+34° 7'$.

A and B.

1889.425	17.5	22.19	7.5 , 9.5	36
.430	17.6	22.80	7.5 , 12	12
.436	17.4	22.28	7 , 11	36
1889.43	17.5	22.42	7.3 , 10.8	

A and C.

1889.425	14.0	41.54	— , 11.5	36
.436	15.1	41.58	— , 12.5	36
1889.43	14.5	41.56	— , 12	

Discovered by Hough. This star was measured in consequence of a note by Bakhuyzen (Bulletin Int. Phot. Congress III.218) as follows:

»Le changement dans la position des deux composantes de l'étoile double DM. +34°3916 (position pour 1875.0 $\alpha = 20^h 8^m 8^s$, $\delta = +34° 6' 2''$), est fort intéressant; je n'ai pu en trouver d'autres observations.«

There is certainly no change in B, as Ho. found:

1884.71 17°.8 21".43 Ho. 2n.

The distant star is only roughly given: 40°, 42".

α^2 Capricorni.

RA. $20^h 11^m 24^s$ Decl. $-12° 55'$.

B and C (A. G. Clark).

1889.463	238.0	1.08	11.5, 11.7	36
.471	239.7	1.26	11.5, 11.6	36
.502	239.2	1.22	11 , 11.1	36
1889.48	239.0	1.19	11.3, 11.5	

A and B (= H_2 608).

1889.463	145.7	7.86	— , —	36
.471	146.3	7.69	— , —	36
.502	148.5	7.70	— , —	36
1889.48	146.8	7.75	— , —	

The change, if any, in the close pair is very slow.

β 431.

RA. $20^h 15^m 25^s$ Decl. $+35° 53'$.

1889.523	41.9	0.65	8.5, 8.5	12
.526	33.3	0.70	8.5, 8.5	12
.531	39.7	0.68	8.6, 8.6	36
.534	38.1	0.60	8.7, 8.7	36
1889.53	38.2	0.66	8.6, 8.6	

Probably unchanged. The following are all the measures:

1877.33	220°.8	0".56	De	5n.
1884.84	53.1	0.42	En	7n.

β 763. $\varkappa^2$ Sagittarii.

RA. $20^h15^m45^s$ Decl. −42°48′.

1889.430	209°.8	1″.49	6 , 8.5	12
.460	210.9	1.38	6 , 9	12
.468	213.1	1.31	6 , 10	12
.523	210.9	1.15	6 , 8	12
1889.47	211.2	1.33	6 , 8.9	

β 151. β Delphini.

RA. $20^h31^m55^s$ Decl. +14°11′.

A and B.

1889.422	309°1	0″.32	—, —	36
.502	315.8	0.32	—, —	36
.515	315.7	0.24	—, —	36
.520	314.6	0.35	—, —	36
.537	315.9	0.31	—, —	36
1889.50	314.2	0.31	—, —	

β 675. 51 Cygni.

RA. $20^h38^m31^s$ Decl. +49°54′.

1889.438	104.2	3″.18	5 , 13.5	36
.460	97.5	2.82	5 , 12.5	36
.463	102.7	2.98	5 , 13.5	36
1889.45	101.5	2.99	5 , 13.2	

The only other measures are:

1878.24 101°.5 2″.78 β 3n.

Σ 2758. 61 Cygni.

RA. $21^h1^m14^s$ Decl. +38°8′.

1889.463, .502 | Both stars single in the 36 inch with powers up to 1000.

β 679.

RA. $21^h1^m25^s$ Decl. +43°12′.

1889.436	67.2	0″.58	10 , 10	36
.438	67.1	0.47	10 , 10	36
.463	62.4	0.51	10 , 10	36
1889.45	65.6	0.52	10 , 10	

One of the smallest close pairs known. It is too faint to be included in the DM. I expected to find some motion, but the measures do not show it.

1878.10 68°.1 0″.38 β 2n.

β 836.

RA. $21^h2^m27^s$ Decl. +47°54′.

A and B.

1888.885	190.2	0″.70	9.5, 9.5	12
9.422	194.2	0.66	9 , 9	36
9.433	190.1	0.60	9 , 9	36
9.436	191.3	0.58	9 , 9	36
1889.29	191.4	0.63	9.1, 9.1	

C and D.

1888.885	241°.7	—	10, —	12
9.422	65.0	1″.28	10, 11	36
9.433	66.7	1.26	10.5, 11.5	36
9.436	66.5	1.27	10, 11	36
1889.29	65.0	1.27	10.2, 11.2	

AB and C.

1888.885	220.1	27″.13	—, —	12
9.422	219.7	27.46	—, —	36
9.433	219.2	27.64	—, —	36
9.436	218.8	27.59	—, —	36
1889.29	219.4	27.45	—, —	

The duplicity of C was suspected at the time of finding the other pair:

1881.63 191°.4 0″.62 β 3n.

β 159.

RA. $21^h6^m21^s$ Decl. +47°12′.

A and B.

1889.526	317.3	1″.19	7 , 10	12
.531	315.2	1.42	7.3, 9	36
.534	317.5	1.22	7 , 10	36
1889.53	316.7	1.28	7.1, 9.7	

A and C (= OΣ App. 215).

1889.526	189.3	134″.34	—, 7.5	12
.534	189.6	133.99	—, 7.2	36
1889.53	189.4	134.16	—, 7.3	

There is a faint star near AB, about 14″ distant, in the direction of 147°. The principal stars seem to be relatively fixed:

1876.69	318°.4	1″.33	De 7n. AB
1875.72	189.6	134.14	De 4n. AC

OΣ 535. δ Equulei.

RA. $21^h8^m38^s$ Decl. +9°31′.

1889.515. Slight elongation with the 36 inch in the direction of 343°.2. Distance not more than 0″.10. The measures last year gave:

1888.69 189°.9 0″.25 β 4n.

Alvan G. Clark. τ Cygni.

RA. $21^h10^m0^s$ Decl. +37°32′.

1889.438	34.4	0.63	—, 9.5	36
.502	31.0	0.58	—, 10	36
.509	32.3	0.42	—, 10	36
.515	36.5	0.38	—, 10	36
1889.49	36.5	0.50	—, 10	

I was unable to see this star double last year, and it is now very difficult. The angular motion since the last measure in 1880 is about 100°.

β 766. δ Microscopii.
RA. 21h16m49s Decl. −41°31′.

1889.430	307°.1	1".06	5 , 7	12

β 989. ϰ Pegasi.
RA. 21h39m12s Decl. +25°6′.

A and B.

1889.509	269.1	0.15	4 , 5	36
.512	256.1	0.16	5 , 5.5	36
.515	265.6	0.13	4 , 4.5	36
.526	258.3	0.12	4 , 5	36
1889.51	262.3	0.14	4.3, 5	

This pair, which has always been close and difficult, seems to be closing up. The following are all the measures:

1880.68	137°.9	0".27	β 4n.
1888.78	274.7	0.23	β 3n.

The first angle may possibly require a correction of 180°.

β 690. μ Cephei.
RA. 21h39m50s Decl. +58°14′.

1889.520	259.5	19.56	6 , 13	36
.537	259.7	19.51	— , 13	36
.540	259.6	19.66	— , 13.5	36
1889.52	259.6	19.58	6 , 13.2	

Herschel's variable »garnet star«. The only other measures are:

1878.87	259°.4	19".16	β 3n.

β 290. 34 Pegasi.
RA. 22h20m30s Decl. +3°47′.

1889.589	218.6	2.85	6 , 12	36
.633	218.7	2.59	6 , 11.5	36
.673	218.7	2.70	5.5, 11.5	36
1889.63	218.7	2.71	5.8, 11.7	

Apparently unchanged:

1878.49	218°.9	2".62	β 5n.

β 291.
RA. 22h21m39s Decl. +3°55′.

1889.589	165.0	0.40	8 , 8.5	36
.633	170.3	0.49	8.5, 8.7	36
.673	167.3	0.49	8.6, 8.8	36
1889.63	167.5	0.46	8.4, 8.7	

The following are all the measures:

1875.82	157°.8	0".32	De 4n.
1878.64	160.0	0.42	β 1n.
1880.08	165.5	0.50	β 2n.

Σ 2912. 37 Pegasi.
RA. 22h23m54s Decl. +3°49′.

1889.589. Single with 36 inch.

β 382. B.A.C. 7983.
RA. 22h48m18s Decl. +44°7′.

A and B.

1889.523	215°.8	0".94	7.5, 9	12
.526	216.1	1.08	7 , 9	12
.534	220.9	0.94	7.3, 8.5	36
1889.53	217.6	0.98	7.3, 8.8	

A and C (= H_2 1828).

1889.526	353.9	26.99	— , 10.5	12
.534	353.6	26.86	— , 9.5	36
1889.53	353.7	26.92	— , 10	

Some evidence of motion in the close pair:

1876.39	205°.7	1".07	De 7n.
1881.70	210.1	1.09	β 3n.

Barnard. ϰ Piscium.
RA. 22h53m18s Decl. +0°19′.

1889.553	96.0	3.87	6 , 14	36
.556	91.8	3.88	6 , 13.5	36
.589	93.1	3.68	6 , 13.5	36
1889.57	93.6	3.81	6 , 13.7	

Discovered by Mr. E. E. Barnard with the 12 inch of this Observatory.

β 718. 64 Pegasi.
RA. 23h16m3s Decl. +31°9′.

1889.473	85.9	0.70	5.5, 9	12
.515	87.3	0.66	6 , 8.5	36
.523	85.3	0.70	6 , 9	12
1889.50	86.2	0.69	5.8, 8.8	

Probably not much change.

OΣ 496. Pi. 23h100.
RA. 23h24m29s Decl. +57°53′.

A and B.

1889.578	343.5	1.22	6 , 11	36
.583	339.2	1.39	— , —	12
.589	343.6	1.22	6 , 12	36
1889.58	342.1	1.28	6 , 11.5	

C and D.

1889.578	226.3	1.55	7.5, 8.5	36
.583	224.9	1.61	— , —	12
.586	221.0	1.38	7.5, 8.7	36
1889.58	224.1	1.51	7.5, 8.6	

A and C.

1889.583	268.9	75.56	— , —	12
.586	269.0	75.50	— , —	36
1889.59	269.0	75.53	— , —	

A small star 231".07 from A, in the direction of 207°.6, is a close double. It is given in the list of new pairs.

Σ 3022.

RA. 23h 25m 7s Decl. +57° 45'.

1889.578	226°.4	20".28	8.5, 8.8	36
.583	226.2	20.31	8.8, 9.5	12
.586	226.2	20.49	8.5, 9	36
1889.58	226.3	20.36	8.6, 9.1	

Without change:

1832.15 226°.7 20".49 Σ.

A tenth magnitude star 116".88 from A in the direction of 189°.7 is a close double, and will be found in the list of new pairs.

β 720. 72 Pegasi.

RA. 23h 28m 0s Decl. +30° 40'.

1889.473	145.6	0.34	—, —	12
.515	144.9	0.37	6, 6	36
.526	147.4	0.47	6, 6	36
1889.50	146.0	0.38	6, 6	

There is evidently some change in this pair. The following are all the measures:

1878.74 127°.7 0".40 β 7n.
1878.74 128.7 0.37 De 1n.
1880.01 311.0 0.41 β 3n.
1883.40 147.6 0.25 En 7n.

A.G.C. 14. 78 Pegasi.

RA. 23h 37m 57s Decl. +28° 42'.

1889.468	196.0	1.45	5.5, 10	12
.473	195.8	1.38	5, 9	12
.509	199.1	1.50	6, 10	36
1889.48	197.0	1.44	5.5, 9.7	

There may be a slight advance in the angle

1876.59 192°.0 1".45 De 4n.
1878.77 191.8 1.61 β 2n.

Barnard. W_1 23h803.

RA. 23h 40m 53s Decl. +4° 35'.

1889.553	166.2	0.49	8.7, 8.7	36
.556	166.5	0.59	8.6, 8.6	36
.589	166.0	0.53	8.5, 8.5	36
1889.57	166.2	0.54	8.6, 8.6	

Discovered with the 12 inch by Mr. E. E. Barnard.

β 995.

RA. 23h 41m 35s Decl. +46° 10'.

1889.468	244.6	0.91	6, 10	12
.473	242.2	0.99	6, 9.5	12
.509	243.4	0.89	6.5, 11	36
1889.48	243.4	0.93	6.2, 10.2	

The only other measures are:

1879.61 242°.0 0".68 Cinc. 1n.
1880.01 245.4 0.88 β 2n.

β 996.

RA. 23h 46m 31s Decl. +74° 53'.

1889.512	70°.1	5".68	6.8, 13	12
.515	67.0	5.94	6, 13	36
.518	66.9	5.70	6.5, 11.5	36
1889.51	68.0	5.77	6.4, 12.5	

The only other measures are:

1880.64 64°.7 5".52 β 4n.
1888.74 67.1 5.43 β 3n.

The small star evidently has the same proper motion as the principal component, Radcl. 6203. This, according to Argelander, is 0".298. in the direction of 88°.3.

β 730. 27 Piscium.

RA. 23h 52m 32s Decl. −4° 13'.

1889.553	267.8	1.52	4.5, 11	36
.556	266.7	1.59	5.5, 12.5	36
.594	267.6	1.39	5, 10.5	36
1889.57	267.4	1.50	5, 11.3	

For comparison we have:

1878.49 265°.2 1".49 β 5n.

β 733. 85 Pegasi.

RA. 23h 55m 52s Decl. +26° 27'.

A and B.

1889.515	130.7	0.98	—, 11	36
.523	132.2	0.97	—, 11	36
.594	136.1	0.98	—, 11	36
.633	138.3	0.85	—, 11.5	36
.687	136.1	0.96	—, 11.5	36
1889.59	134.7	0.94	—, 11.2	

A and C.

1889.473	358.6	22.77	—, —	12
.509	359.0	22.68	6, 9	36
.515	358.4	22.68	—, 9	36
.523	358.8	22.54	—, 9	36
1889.50	358.7	22.66	—, —	

Mr. J. M. Schaeberle, who computed the orbit of the close pair (Gould's Journal, 185), using all the measures down to and including those made here last year, gives the calculated position angle for 1889.59 as 132°.8, and the distance, 1".03.

Σ 3057.

RA. 23h 58m 43s Decl. +57° 52'.

1889.553	120.0	3.62	6.6, 8.8	36
.578	120.0	3.70	7, 9.5	36
.589	120.2	3.65	6.7, 9	36
1889.57	120.1	3.66	6.8, 9.1	

Σ 3062.

RA. 23h 59m 57s Decl. +57° 46'.

1889.553	322.1	1.33	6.5, 7.5	36
.578	321.8	1.46	6.5, 7.5	36
.583	319.5	1.55	6.6, 7.5	12
1889.57	321.1	1.45	6.5, 7.5	

New Nebulae.

Several new nebulae have been incidentally noted in the course of the foregoing observations, but they are nearly all in the field with bright stars, or double stars. The lowest power used in the double star measures has a field of only 5′ in diameter, so that faint nebulae would not be noticed unless quite near the star under examination. The places of some of these have been accurately determined by Mr. Barnard with the 12 inch equatorial. I have measured two with the 36 inch as follows:

ω Piscium and nebula.

RA. $23^h 53^m 9^s$ Decl. $+6° 12'$.

1889.630	278°.6	164″.51	—, —	36
.633	278.0	164.09	—, —	36
1889.63	278.3	164.30	—, —	

Lal. 39690 and nebula.

RA. $20^h 29^m 37^s$ Decl. $-0° 25'$.

1889.633	257°.1	84″.50	—, —	36
.668	256.9	84.20	—, —	36
1889.65	257.0	84.35	—, —	

Both are faint objects with the large telescope. The places given are those of the respective stars.

Lick Observatory 1889 Aug. 20.

P.1760

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Double-Star Observations

made at the Lick Observatory by *S. W. Burnham.*

(Communicated by the Director Prof. *Edward S. Holden.*)

The following are the principal double-star observations made by me with the thirty-six and twelve inch refractors of the Lick Observatory in August, September and October of the present year. In this list, as a rule, only the stars are given which have been measured on at least three nights. Unless otherwise stated in the notes, the new double-stars were discovered with the 12 inch telescope. The aperture of the instrument with which the micrometrical measures were made is given in the last column.

New Double-Stars.

Lal. 58.

RA. $0^h 5^m 48^s$ Decl. $+52° 57'$.

1888.733	326°0	—	8 , 9	12
.736	338.9	0".51	8 , 8.5	12
.785	322.0	0.43	8 , 9	12
.796	331.7	0.50	8.5 , 9	12
1888.76	329.6	0.48	8.1 , 8.9	

This star is 7^m in Lal., and 6.5 in DM.

W_2 $0^h 200$ = DM. $+20° 15$.

RA. $0^h 8^m 44^s$ Decl. $+20° 50'$.

1888.815	187.3	1.60	7 , 10	36
.821	186.1	1.57	7.5 , 10.5	12
.832	187.1	1.44	7 , 10.5	12
1888.82	186.8	1.54	7.2 , 10.3	

Discovered with the 36 inch.

γ Cassiopeiae.

RA. $0^h 48^m 50^s$ Decl. $+60° 1'$.

1888.668	255.0	2.17	— , 11	36
.671	255.2	2.13	— , —	36
.678	254.7	2.03	— , 11	36
.681	257.5	2.33	— , 11.5	12
.695	254.9	2.26	— , 11	36
.733	258.0	2.17	— , 11	12
1888.69	255.9	2.18	— , 11	

Discovered with the 36 inch. Well seen with the 12 inch. The following measures were made of the distant companion (= β 499):

1888.678	348.8	52.53	— , 14	36
.695	348.4	52.35	— , 13	36

The two sets of measures indicate no change:

1878.80 348.6 52".27 β 2n
1888.68 348.6 52.44 β 2n.

ζ Piscium.

RA. $1^h 7^m 27^s$ Decl. $+6° 56'$.

B and C.

1888.681	244°0	0".98	— , 11.5	12
.695	248.2	0.91	— , 10	12
.714	254.7	0.88	— , 11.5	12
.720	247.1	0.94	— , 11.5	12
.733	249.6	0.96	— , 11	12
1888.71	248.7	0.93	— , 11	

A and B (= Σ 100).

1888.681	63.4	23".75	— , —	12
.695	64.0	23.86	— , —	12
.698	63.1	23.91	— , —	12
.714	63.5	23.61	— , —	12
.733	63.6	23.48	— , —	12
1888.71	63.5	23.72	— ,	

The bright stars appear to be relatively fixed, but with a common proper motion. Struve found:

1832.83 63°.7 23".46.

W_2 $3^h 5$ = DM. $+21° 413$.

RA. $3^h 3^m 11^s$ Decl. $+21° 17'$.

1888.821	162.1	0.64	8 , 8	12
.832	168.3	0.63	8.5 , 8.5	12
.835	163.3	0.47	8.6 , 8.6	12
1888.83	164.6	0.58	8.4 , 8.4	

Discovered with the 36 inch.

α Tauri (Aldebaran).

RA. $4^h 29^m 2^s$ Decl. $+16° 16'$.

A and B (= β 550).

1888.813	110.0	30".88	— , —	36
.835	109.0	30.91	— , —	36
1888.82	109.5	30.90	— , —	

A and C (= Σ 2 App. II).

1888.772	35°.7	116″.98	—, —	36
.813	34.5	116.88	—, —	36
.832	34.5	116.86	—, —	12
1888.81	34.9	116.91	—, —	

C and D.

1888.772	286.0	3.02	—, 12	36
.813	279.5	2.00	9, 12	36
.835	277.7	2.00	9, 12	36
1888.81	281.1	2.34	9, 12	

The faint star near the old companion was detected with the 36 inch.

σ Orionis.

RA. $5^h 32^m 43^s$ Decl. −2° 40′.

A and B.

1888.775	358.3	0.18	4, 6	12
.813	356.2	0.27	4, 6	36
.818	356.4	0.27	—, —	36
.832	357.1	0.32	, —	36
1888.81	357.0	0.26	—, —	

AB and C (Σ 762).

1888.832	236.7	11.04	—, —	12
.832	236.8	11.42	—, —	36
.851	237.9	11.24	—, —	12
1888.84	237.1	11.23	—, —	

AB and D (Σ 762).

1888.832	83.9	12.90	—, —	12
.832	83.2	12.97	—, —	36
.851	82.8	12.66	—, —	12
1888.84	83.3	12.84	—, —	

AB and E.

1888.851	60.5	41.18	—, —	12

This star has been known as a wide triple since H. There is no change in old companions. Σ gives:

1831.42	236°.5	11″.00
1831.20	84.5	12.86

The close pair is difficult with the 12 inch, with which it was discovered.

ν^2 Sagittarii.

RA. $18^h 47^m 51^s$ Decl. −22° 49′.

1888.681	104°.0	1″.37	5½, 11	12

Discovered with the 36 inch.

7 Aquarii.

RA. $20^h 50^m 25^s$ Decl. −10° 9′.

1888.600	164.6	1.90	7, 13	12
.613	168.1	2.03	6, 12	12
.714	165.3	2.21	6, 11	12
.731	162.9	2.15	6, 11.5	12
.733	164.0	2.18	6, 11	12
1888.68	165.0	2.09	6, 11.7	

Found with the 36 inch.

B.A.C. 7422.

RA. $21^h 17^m 16^s$ Decl. −26° 4′.

1888.714	199.2	0.96	8, 10.5	12
.733	199.9	1.08	8, 11	12
.777	197.1	1.10	8, 10.5	12
1888.74	198.7	1.05	8, 10.7	

Yarn. 9529.

RA. $21^h 40^m 59^s$ Decl. −17° 51′.

1888.675	204.8	4.62	7½, 11.5	12
.763	204.4	4.67	8, 11	12
.777	205.7	4.30	8.5, 11	12
1888.74	205.9	4.53	8, 11	

W_1 $22^h 8^m 54^s$ = DM. +12°.4888.

RA. $22^h 41^m 56^s$ Decl. +12° 22′.

1888.777	226.6	—	—, —	12
.796	221.9	0.72	8.5, 10.8	12
.832	228.2	0.68	8.5, 10.5	12
.835	220.9	0.58	9, 11	12
1888.81	224.4	0.66	8.7, 10.8	

Found with the 36 inch. The preceding star of a wide pair.

DM. +41°.4881.

RA. $23^h 45^m 31^s$ Decl. +41° 25′.

1888.681	160.5	0.64	8, 8	12
.755	157.5	0.55	8.5, 8.5	12
.763	154.9	0.62	8.3, 8.3	12
1888.73	157.6	0.60	8.3, 8.3	

In DM. $6^m.7$, but only $7^m.4$ in Radcliffe.

Micrometrical Measures of Double-Stars.

β 392 (B.A.C. 46).

RA. $0^h 10^m 31^s$ Decl. +60° 52′.

1888.706	67°.9	19″.71	6, 13	12
.709	68.8	19.41	7, 11.5	12
.711	67.8	20.28	—, 12.5	12
1888.71	68.2	19.80	6.5, 12.3	

No other measures of this pair.

β 491 (δ Andromedae).

RA. $0^h 32^m 54^s$ Decl. +30° 12′.

1888.706	300°.2	27″.05	—, 13	12
.709	298.4	28.00	—, 12	12
.711	300.4	27.74	—, —	12
1888.71	299.7	27.60	—, 12.5	

The only other measures are:

1878.40 299°.3 27″.86 β 3n.

β 231 (o Cassiopeiae).
RA. $0^h 38^m 2^s$ Decl. $+47° 38'$.

1888.706	303°6	32".89	—, 11.5	12
.709	303.1	32.50	—, 11.5	12
.711	303.9	32.50	—, 11.8	12
1888.71	303.5	32.63	—, 11.6	

The only earlier measure is:

1876.51 303°9 32".81 De 1n.

β 396 (B.A.C. 282).
RA. $0^h 56^m 13^s$ Decl. $+60° 26'$.

1888.681	66.5	1.27	6.5, 10	12
.720	66.4	1.14	6.3, 9	12
.733	66.8	1.22	6.3, 8.5	12
.758	67.4	1.37	6, 9.5	12
1888.72	66.8	1.25	6.3, 9.3	

No evidence of change:

1877.05 66°4 1".24 De 4n.

β 999 (o Andromedae).
RA. $1^h 20^m 27^s$ Decl. $+44° 47'$.

A and B.

1888.681	95.2	2.29	—, 12	12
.706	94.7	2.73	—, 11.5	12
.711	96.3	2.90	—, —	12
1888.70	95.4	2.64	—, 11.8	

A and C.

1888.706	110.4	132.62	—, —	12
.709	110.5	132.55	—, —	12
.851	109.9	132.30	—, —	12
1888.75	110.3	132.49	—, —	

C and D.

1888.706	136.5	5.06	10.5, 10.5	12
.709	138.7	4.91	10, 10	12
.851	137.5	4.91	—, —	12
1888.75	137.9	4.96	10.2, 10.2	

There is a faint star between the pairs.

β 506 (η Piscium).
RA. $1^h 25^m 4^s$ Decl. $+14° 44'$.

1888.695	14.7	1.25	—, 11	36
.720	16.2	1.03	—, 10	12
.785	18.6	1.02	—, 9	12
1888.73	16.5	1.10	—, 10	

The only other measures are:

1878.73 12°9 1".02 β 3n
1880.12 14.2 1.16 β 3n.

β 513 (48 Cassiopeiae).
RA. $1^h 52^m 7^s$ Decl. $+70° 19'$.

1888.681	295°2	0".72	5, 6	12
.698	299.2	0.72	4½, 6	12
.706	294.9	0.76	5, 6½	12
.720	303.1	1.10	5, 6½	12
1888.70	298.1	0.83	5, 6.3	

Rapid angular motion is well shown:

1878.69 265°0 1".05 De 1n
1878.90 264.3 1.00 β 4n.

$O\Sigma$ 38 (γ Andromedae).
RA. $1^h 56^m 32^s$ Decl. $+41° 45'$.

1888.600. Only a slight elongation in the direction of 120° with 2700 on the 36 inch.

β 535 (38 Persei).
RA. $3^h 36^m 47^s$ Decl. $+31° 54'$.

1888.678	55.3	0.99	—, —	36
.681	61.9	1.19	—, 9	12
.785	60.5	1.10	—, 8.5	12
1888.71	59.2	1.09	—, —	

The following are all the earlier measures:

1877.84 60°5 0".96 De 1n
1878.25 56.8 0.93 β 4n.

β 547 (47 Tauri).
RA. $4^h 7^m 25^s$ Decl. $+8° 58'$.

1888.775	363.2	0.98	—, —	12
.821	359.0	0.90	5, 8	12
.832	357.0	0.85	5.5, 8.5	12
1888.81	359.7	0.91	—, —	

There seems to be no relative motion thus far:

1877.90 359°7 0".82 De 3n
1878.42 359.7 0.89 β 6n.

Σ 518 (40 Eridani).
RA. $4^h 9^m 52^s$ Decl. $-7° 47'$.

B and C.

1888.832	107.5	3.26	—, —	12
.851	106.7	2.96	—, —	12
.859	106.3	2.59	—, —	12
1888.84	106.8	2.94	—, —	

A and B.

1888.838	105.6	82.28	—, —	12
.851	105.4	82.03	—, —	12
1888.84	105.5	82.15	—, —	

Procyon.

RA. $7^h 33^m 1^s$ Decl. $+5° 33'$.

1888.818. Carefully examined with all powers up to 3300 on the 36 inch under favorable conditions. Large star single, and no near companion.

A. C. 15 99 Herculis.

RA. $18^h 2^m 28^s$ Decl. $+30° 33'$.

1888.733. Apparently single with the 36 inch, as on previous nights with the 12 inch. The last measure of this pair was made by me in 1881.

ξ Sagittarii.

RA. $18^h 55^m 0^s$ Decl. $-30° 3'$.

1888.592	260°.1	0".55	— , —	12
.600	255.9	0.66	— , —	12
.605	258.4	0.86	— , —	12
.613	255.4	0.73	— , —	12
.636	256.8	0.64	— , —	12
.681	257.9	0.75	— , —	12
1888.62	257.4	0.70	— , —	

An interesting pair discovered by Winlock, of which there are but few measures. Possibly some of the observations require a correction of 180° in the angles, but this matter was given careful attention in the measures of 1878–80, and there seemed to be no doubt of the smaller component being on the following side. It is certainly on the preceding side now. The difference is about one half a magnitude. This pair is probably in rapid motion, and should be regularly measured.

The following are the earlier measures:

1867.80	260°.8	0".48	Newc.	1 n
1878.70	84.2	0.42	β	1 n
1879.71	54.8	0.3 ±	β	1 n
1880.62	62.1	0.55	β	2 n
1881.61	36.1	0.31	β	2 n.

β Capricorni.

RA. $20^h 14^m 2^s$ Decl. $-15° 10'$.

1888.644	114.5	0.90	— , 10	12
.652	100.3	0.66	— , —	12
.655	101.8	0.73	— , —	12
.714	107.0	1.08	— , 9	12
1888.66	105.9	0.84	— , —	

Discovered by Barnard in 1883 during an occultation by the moon. The only other measures are:

1884.59	105°.8	0".85	β	3 n
1886.72	109.6	0.83	Ho	2 n.

β 151 (β Delphini).

RA. $20^h 31^m 55^s$ Decl. $+14° 11'$.

A and B.

1888.592	306°.4	0".28	— , —	12
.605	300.6	0.43	— , —	12
.613	327.1	0.35	— , —	12
.652	300.2	0.20	— , —	12
.655	323.9	0.16	— , —	12
.714	300.0	0.21	— , —	12
.723	312.8	0.37	— , —	12
1888.65	310.1	0.29	— , —	

A and C.

1888.813	116.6	27.00	— , —	36
.838	114.8	26.54	— , —	12
1888.82	115.7	26.77	— , —	

A and D (= Σ 2704).

1888.813	332.8	36.57	— , —	36
.838	333.6	36.13	— , —	12
1888.82	333.2	36.35	— , —	

The last orbit computed (Celoria, A. N. 2824) gives a period of 16.95 years. The latest published measures are by Engelmann (A. N. 2786):

1886.91 219°.5 0".39 4n.

Ho. 149.

RA. $21^h 1^m 26^s$ Decl. $-12° 10'$.

1888.714	328.8	0.81	8 , 8.4	12
.717	327.0	1.13	8 , 8.5	12
.731	325.3	0.86	8.3 , 8.7	12
.733	326.2	—	8.5 , 9.0	12
1888.72	326.8	0.90	8.2 , 8.7	

Discovered by Hough at Chicago. He makes the components equal, and gives:

1885.25 155°.4 0".54 8.5 , 8.5 2 n.

γ Equulei.

RA. $21^h 4^m 30^s$ Decl. $+9° 39'$.

A and B.

1888.813	276.0	2.37	— , —	36
.821	274.3	1.90	— , —	12
.835	275.9	2.14	— , —	12
1888.82	275.4	2.14	— , —	

A and C.

1888.813	8.9	43.26	— , —	36
.821	11.2	43.41	— , —	12
.835	7.6	43.31	— , —	12
1888.82	9.2	43.33	— , —	

Close star discovered by Knott. Apparently fixed.

1867.50 276°.8 2".13 Knott.

$O\Sigma$ 535 (δ Equulei).

RA. $21^h 8^m 38^s$ Decl. $+9° 31'$.

1888.652	188°7	0".24	—, —	12
.655	186.3	0.23	—, —	12
.714	190.0	0.29	—, —	12
.733	194.7	—	—, —	12
1888.69	189.9	0.25	—, —	

Glasenapp (A. N. 2771) finds a period of 11.5 years, making this the most rapid binary known. His ephemeris makes the position angle 201°7 and the distance 0".44 for 1888.21. In the first measure given above it was noted that the smaller component was on the following side. The measured distance is certainly not too small.

β 989 ($\varkappa$ Pegasi).

RA. $21^h 39^m 12^s$ Decl. $+25° 6'$.

A and B.

1888.711	270.7	0.33	—, —	12
.818	275.4	0.15	—, —	36
.824	278.0	0.22	—, —	36
1888.78	274.7	0.23	—, —	

A and C (Σ 2824).

1888.818	300.8	12.00	—, —	36
.824	300.7	12.43	—, —	36
1888.82	300.7	12.22	—, —	

This close and difficult pair, discovered in 1880, is apparently in rapid motion. The only other measures are:

1880.68 137°9 0".27 β 4n.

β 276 (η Piscis Austrini).

RA. $21^h 53^m 57^s$ Decl. $-29° 2'$.

1888.731	116.3	1.04	5 , 5½	12
.782	119.7	—	6 , 6.2	12
.793	118.7	1.98	—, —	12
.796	119.3	1.80	—, —	12
1888.78	118.5	1.61	—, —	

β 174.

RA. $22^h 22^m 58^s$ Decl. $-10° 17'$.

1888.675	289.7	8.05	8 , 10.5	12
.796	293.2	9.08	8.5 , 10.5	12
.832	292.1	8.73	8.5 , 11	12
1888.77	291.7	8.62	8.3 , 10.7	

Dembowski made the distance 7".38 in 1876, but later measures at Chicago and Cincinnati indicate substantially the value given above.

β 703 (α Lacertae).

RA. $22^h 26^m 20^s$ Decl. $+49° 40'$.

1888.706	297.6	31.75	—, 13	12
.709	297.6	31.41	—, 11.5	12
.711	298.1	31.61	—, 12	12
1888.71	297.8	31.59	—, 12.2	

The only other measures are:

1878.02 298°8 30".16 β 2n.

β 77.

RA. $22^h 27^m 51^s$ Decl. $-2° 24'$.

A and B.

1888.731	213°5	2".70	8.2 , 8.5	12
.733	213.0	2.96	8.5 , 8.7	12
.782	213.3	2.64	8.8 , 9.0	12
1888.75	213.3	2.77	8.5 , 8.7	

A and C.

1888.731	226.4	28.28	—, 11	12
.733	224.7	29.24	—, 10.8	12
.782	225.7	28.87	—, 11.5	12
1888.75	225.6	28.80	—, 11	

Probably without change.

β 451 (15 Lacertae).

RA. $22^h 46^m 37^s$ Decl. $+42° 40'$.

1888.706	129.3	29.25	5 , 12	12
.709	128.4	28.89	—, 12	12
.711	127.8	30.65	—, 12	12
1888.71	128.5	29.60	—, 12	

No other measures.

β 80.

RA. $23^h 12^m 42^s$ Decl. $+4° 45'$.

1888.675	321.6	0.94	8.5 , 9	12
.711	319.0	0.99	8 , 9	12
.714	318.1	0.83	8 , 8.7	12
.731	319.4	0.92	8.3 , 8.8	12
1888.71	319.5	0.92	8.2 , 8.9	

Argelander gave the proper motion of this star 0".558 in the direction of 101°5. From a comparison of the above measures with the earlier observations, it is evident that it is a physical pair.

1875.80 300°4 1".07 De 4 n
1881.69 312.2 0.91 β 3n.

Ho. 199 (95 Aquarii).

RA. $23^h 12^m 43^s$ Decl. $-10° 16'$.

1888.714	223.3	1.31	4 , 11	12
.717	226.0	1.13	—, 11.5	12
.736	219.0	1.21	—, 12	12
1888.72	222.8	1.22	—, 11.5	

Hough by a single measure gives:

1884.85 223°5 1".15 1n.

β 718 (64 Pegasi).

RA. $23^h 16^m 3^s$ Decl. $+31° 9'$.

1888.711	93.4	0.51	5.5 , 7	12
.785	84.8	0.68	6 , 8.5	12
.851	81.9	0.92	—, —	12
.859	81.5	0.56	6 , 8	12
1888.80	85.4	0.67	5.8 , 7.8	

The only other measures are:

1878.70 86°9 0".46 β 3n
1878.74 88.7 0.56 De 1n.

β 386 (B.A.C. 8173).

RA. $23^h21^m12^s$ Decl. $+70°1'$.

1888.706	313°6	20".90	7 , 11.5	12
.709	312.0	20.36	7 , 11	12
.711	313.6	20.80	7.5 , 11	12
1888.71	313.1	20.69	7.2 , 11.2	

The only other measures are:

1876.97 312°3 20".08 De 4n.

β 279 (ω^3 Aquarii).

RA. $23^h36^m30^s$ Decl. $-15°12'$.

1888.698	83.2	5.51	5.5 , 11.5	12
.720	83.0	5.97	5 , 10.8	12
.731	83.8	6.10	— , 11	12
1888.71	83.3	5.86	— , 11	

Probably unchanged:

1875.79 87°8 5".68 De 4n.

β 996.

RA. $23^h46^m31^s$ Decl. $+74°53'$.

1888.711	65.2	5.53	7 , 12	12
.733	68.7	5.16	7.5 , 13	12
.785	67.4	5.60	7 , 12	12
1888.74	67.1	5.43	7.2 , 12	

The proper motion given by Argelander of 0".298 in 88°3 is evidently common to both stars.

1880.64 64°7 5".52 β 4n.

β 733 (85 Pegasi).

R.A. $23^h55^m52^s$ Decl. $+26°27'$.

A and B.

1888.668	123.0	0.84	— , —	36
.678	126.1	0.91	— , —	12
.681	132.0	0.97	— , —	12
.695	128.7	1.10	— , —	36
.711	123.9	0.91	— , —	12
1888.69	126.7	0.95	— , —	

A and C.

1888.652	1.4	21.47	— , —	12
.655	0.4	21.86	— , —	12
.663	0.5	22.04	— , —	12
.675	1.4	21.76	— , —	12
.695	0.9	21.40	— , —	36
1888.67	0.9	21.71	— , —	

A and D.

1888.695	283.8	72.02	— , 12	36

Mount Hamilton 1888 Nov. 15.

The close companion, since its discovery in 187[illegible] has passed over about 213° of its orbit. This pair ha always been from the faintness of the companion a difficu object; and all the previous measures were made with th Chicago $18\frac{1}{2}$ inch refractor with which the star was foun The following are all the measures of the close pair:

1878.73	274°0	0".67	β 3n
1879.46	284.6	0.75	β 5n
1880.54	298.3	0.68	β 5n
1881.54	311.5	0.58	β 1n
1883.75	333±	—	β 1n
1888.69	126.7	0.95	β 5n.

Mr. J. M. Schaeberle of this Observatory has recentl computed an approximate orbit, and finds a period o 22.3 years. For the next eight or ten years the distanc should be about the same as at the time of discovery and hence readily measured with moderate apertures.

The change in the position of the third star, C, i due to the proper motion of the principal star. Some o the measures are:

1878.54	33°6	14".40	β 4n
1879.27	30.4	14.96	β 8n
1880.57	25 0	15.41	β 6n
1881.54	20.8	16.29	β 4n
1882.77	17.1	17.34	β 3n
1888.69	0.9	21.71	β 5n.

From the measures of A and C, Mr. Schaeberle find the annual proper motion of the principal star to be 1".30 in the direction of 140°3.

The fourth star D has changed its position from th same cause. The only other measures of this are:

1878.96	277°1	61".73	β 1n
1880.56	278.0	64.25	β 1n.

β 482.

RA. $23^h56^m44^s$ Decl. $+62°39'$.

A and B.

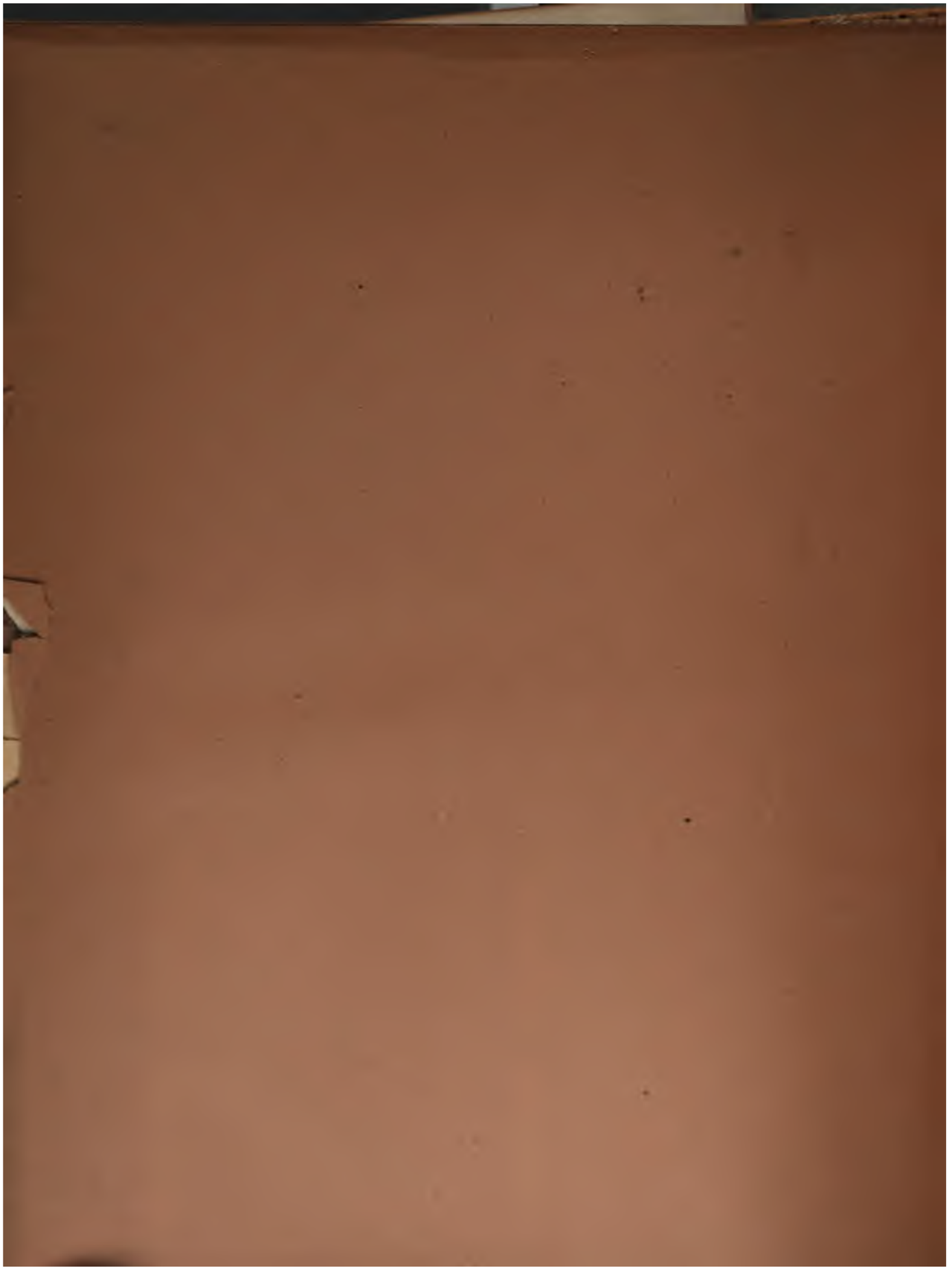
1888.706	344°2	4".61	9 , 10	12
.709	344.1	4.51	9 , 10	12
.711	343.1	4.67	9 , 10	12
1888.71	343.8	4.60	9 , 10	

A and C.

1888.706	126.0	9.99	— , 11	12
.709	124.6	9.80	— , 11	12
.711	121.1	9.57	— , 11.5	12
1888.71	123.9	9.79	— , 11.2	

Dembowski found:

1876.80 342°7 4".07 2n.



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